LOAN DOCUMENT

PHOTOGRAPH THIS SHEET

LEVEL

0

INVENTORY

DTIC ACCESSION NUMBER

Remedial Action Plan for the Expanded . . .

DOCUMENT IDENTIFICATION

May 97

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

DISTRIBUTION STATEMENT

H A N D L E W I T H C A R E

ACCESSION FOR

NTIS GRA&I ☑
DTIC TRAC ☐
UNANNOUNCED ☐
JUSTIFICATION

BY

DISTRIBUTION/

AVAILABILITY CODES

DISTRIBUTION	AVAILABILITY AND/OR SPECIAL	
A-1		

DISTRIBUTION STAMP

DATE ACCESSIONED

DATE RETURNED

20001121 051

DATE RECEIVED IN DTIC

REGISTERED OR CERTIFIED NUMBER

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-FDAC

DTIC FORM 70A JUN 90

DOCUMENT PROCESSING SHEET

PREVIOUS EDITIONS MAY BE USED UNTIL STOCK IS EXHAUSTED.

LOAN DOCUMENT

DTIC QUALITY INSPECTED 4

DRAFT

Remedial Action Plan for the Expanded Bioventing System Eglin Main Base Old Fire Training Area

Eglin Air Force Base
Florida

Prepared For

Air Force Center for Environmental Excellence
Technology Transfer Division
Brooks Air Force Base
San Antonio, Texas

and

AFDTC / EMR
Eglin Air Force Base
Florida

May 1997

726876/cov597

PARSONS ENGINEERING SCIENCE, INC.
57 Executive Park Drive, Suite 500 Atlanta, Georgia 30329

AQ M01-02-0234

DEFENSE TECHNICAL INFORMATION CENTER
REQUEST FOR SCIENTIFIC AND TECHNICAL REPORTS

Title AFCEE Collection

1. Report Availability *(Please check one box)*

☒ This report is available. *Complete sections 2a - 2f.*

☐ This report is not available. *Complete section 3.*

2a. Number of Copies Forwarded 1 each

2b. Forwarding Date July/2000

2c. Distribution Statement *(Please check ONE box)*

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly below. Technical documents MUST be assigned a distribution statement.

☒ DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

☐ DISTRIBUTION STATEMENT B: Distribution authorized to U.S. Government Agencies only.

☐ DISTRIBUTION STATEMENT C: Distribution authorized to U.S. Government Agencies and their contractors.

☐ DISTRIBUTION STATEMENT D: Distribution authorized to U.S. Department of Defense (DoD) and U.S DoD contractors only.

☐ DISTRIBUTION STATEMENT E: Distribution authorized to U.S. Department of Defense (DoD) components only.

☐ DISTRIBUTION STATEMENT F: Further dissemination only as directed by the controlling DoD office indicated below or by higher authority.

☐ DISTRIBUTION STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25, Withholding of Unclassified Technical Data from Public Disclosure, 6 Nov 84.

2d. Reason For the Above Distribution Statement *(in accordance with DoD Directive 5230.24)*

2e. Controlling Office HQ AFCEE

2f. Date of Distribution Statement Determination 15 Nov 2000

3. This report is NOT forwarded for the following reasons. *(Please check appropriate box)*

☐ It was previously forwarded to DTIC on .... *(date)* and the AD number is ....

☐ It will be published at a later date. Enter approximate date if known. ....

☐ In accordance with the provisions of DoD Directive 3200.12, the requested document is not supplied because:

....

Print or Type Name Laura Peña

Signature Laura Peña

Telephone 210-536-1431

(For DTIC Use Only)
AQ Number M01-02-0234

DRAFT

REMEDIAL ACTION PLAN

FOR AN EXPANDED BIOVENTING SYSTEM

AT EGLIN MAIN BASE OLD FIRE TRAINING AREA, SITE FT-28

EGLIN AIR FORCE BASE, FLORIDA

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

BROOKS AIR FORCE BASE, TEXAS

AND

AFDTC/EMR

EGLIN AIR FORCE BASE, FLORIDA

MAY 1997

Prepared by:

PARSONS ENGINEERING SCIENCE, INC.

ATLANTA, GEORGIA

I:\EGLIN\726876\OLDEGRAP\RAP\DRFTRAP.WW6

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This remedial action plan (RAP) presents the scope for an expanded bioventing system for *in situ* treatment of fuel-contaminated soils at the Eglin Main Base Old Fire Training Area (old Eglin FTA) at Eglin Air Force Base (AFB), Florida. This site is also identified as Installation Restoration Program (IRP) Site FT-28. The proposed expanded system activities will be performed by Parsons Engineering Science, Inc. (Parsons ES) [formerly Engineering-Science, Inc. (ES)] for the Air Force Center for Environmental Excellence (AFCEE) Technology Transfer Division (ERT) under Contract No. F41624-92-D-8036, Delivery Order No. 0017. The primary objectives of the bioventing system upgrade are to:

- Provide aerobic *in situ* remediation of fuel-contaminated soils by injection of atmospheric air into soil;
- Sustain aerobic *in situ* biodegradation until hydrocarbon-contaminated soils within the unsaturated zone are remediated to below regulatory approved standards; and
- Provide additional site characterization data for closure.

An extended bioventing pilot test was performed at the old Eglin FTA by Parsons ES from July 1994 through July 1995 to determine if *in situ* bioventing would be a feasible cleanup technology for the fuel-contaminated soils within the unsaturated zone. A radius of oxygen influence of at least 40 feet was observed at the site. Further details on the pilot test procedures and results can be found in the Interim Pilot Test Results Report (ES, 1994).

Following the extended pilot test, soil and soil gas data confirmed significant contaminant degradation in the pilot test area. Based on laboratory results from soil and soil gas samples, significant reductions in total volatile hydrocarbons (TVH), and benzene, toluene, ethylbenzene, and xylenes (BTEX) were observed in soil gas, and significant reductions in total recoverable petroleum hydrocarbon (TRPH) were observed in 2 of 3 soil samples. The soil sample collected from a depth of 3 to 5 feet below land surface (bls) from the vent well (VW) showed an increase in TRPH, however, this can be attributed to the inherent variability of discrete *in situ* soil sampling. More credence is afforded to reductions in BTEX concentrations since these compounds are preferentially biodegraded over TRPH. Significant reductions in BTEX concentrations were observed for all soil samples over the extended pilot test period. In addition, the extended pilot test demonstrated that significant oxygen utilization and biodegradation are continuing at the pilot test locations, and that continued bioventing will sustain the biodegradation. Further details on the pilot test results are presented in Section 3. The success of bioventing at this site supports the recommendation of an expanded (full-scale)

bioventing system as the most economical approach of remediating the remaining hydrocarbon-contaminated soils in the vicinity of the old Eglin FTA.

This RAP addresses soil contamination associated with former burning of waste fuel, water- and solvent-contaminated fuel, waste oil, and virgin JP-4 fuel at the old Eglin FTA. Site investigation data collected to date indicate that the soil contamination exists from near the surface extending to the top of the water table (approximately 40 feet bls). The sources of contamination are the burn pit (approximately 75 feet in diameter) and a former unlined above ground storage tank (AST) area. Available historical data indicate minimal contamination in the surface soil extends beyond the perimeter of the burn pit. However, fuel-related contamination extends throughout much of the subsurface to the water table in the vicinity of the former AST located approximately 225 feet south/southwest of the primary burn pit. The proposed expansion of the bioventing system will provide oxygen to all contaminated soil to facilitate biodegradation of petroleum hydrocarbons.

Pilot test data have been used to design the expanded bioventing system to remediate contaminated soils. The expanded system will consist of the existing air injection VW, four new VWs, and an existing shallow monitoring well to deliver oxygen throughout the remaining unsaturated fuel-contaminated soils. Three new vapor monitoring points (MPs) will also be constructed to monitor contaminant reduction and oxygen influence in the soil gas. The expanded bioventing system will target vadose zone contamination including contamination in the smear zone.

This document is divided into eight sections including this introduction, and one appendix. Section 2 discusses site background and includes a discussion of existing site characterization data. Section 3 provides the results of the extended pilot test conducted at the old Eglin FTA. Section 4 identifies the treatment area of the proposed expanded system; provides construction details of the expanded system; and recommends a proven, cost-effective approach for the remediation of the remaining hydrocarbon-contaminated soils at the site. Procedures for handling investigation-derived waste are described in Section 5, and Base support requirements are listed in Section 6. Section 7 provides key points of contact at Eglin AFB, AFCEE, and Parsons ES; and Section 8 provides the references cited in this document. A design package for the expanded bioventing system is provided in Appendix A.

2. SITE BACKGROUND

2.1 SITE LOCATION

The old Eglin FTA is located in southeastern Okaloosa County, west of the north-south runway and north of Taxiway Number 6 within the main base of Eglin AFB. To reach the FTA from the west gate of Eglin Main Base (intersection of State Route 397 and State Route 189), proceed approximately 1 mile along Eglin Boulevard. Turn left (northwest) onto West Side Road and follow for approximately 1.5 miles to Tactical Air Command (TAC) gate. Turn right (north) onto the perimeter road and follow for approximately 2.25 miles past the ammo storage area. Take the first right (south) after encountering the ammo storage area on the left. Follow this road for approximately 0.75 mile and the road will terminate at the site (Figure 2.1).

2.2 SITE DESCRIPTION

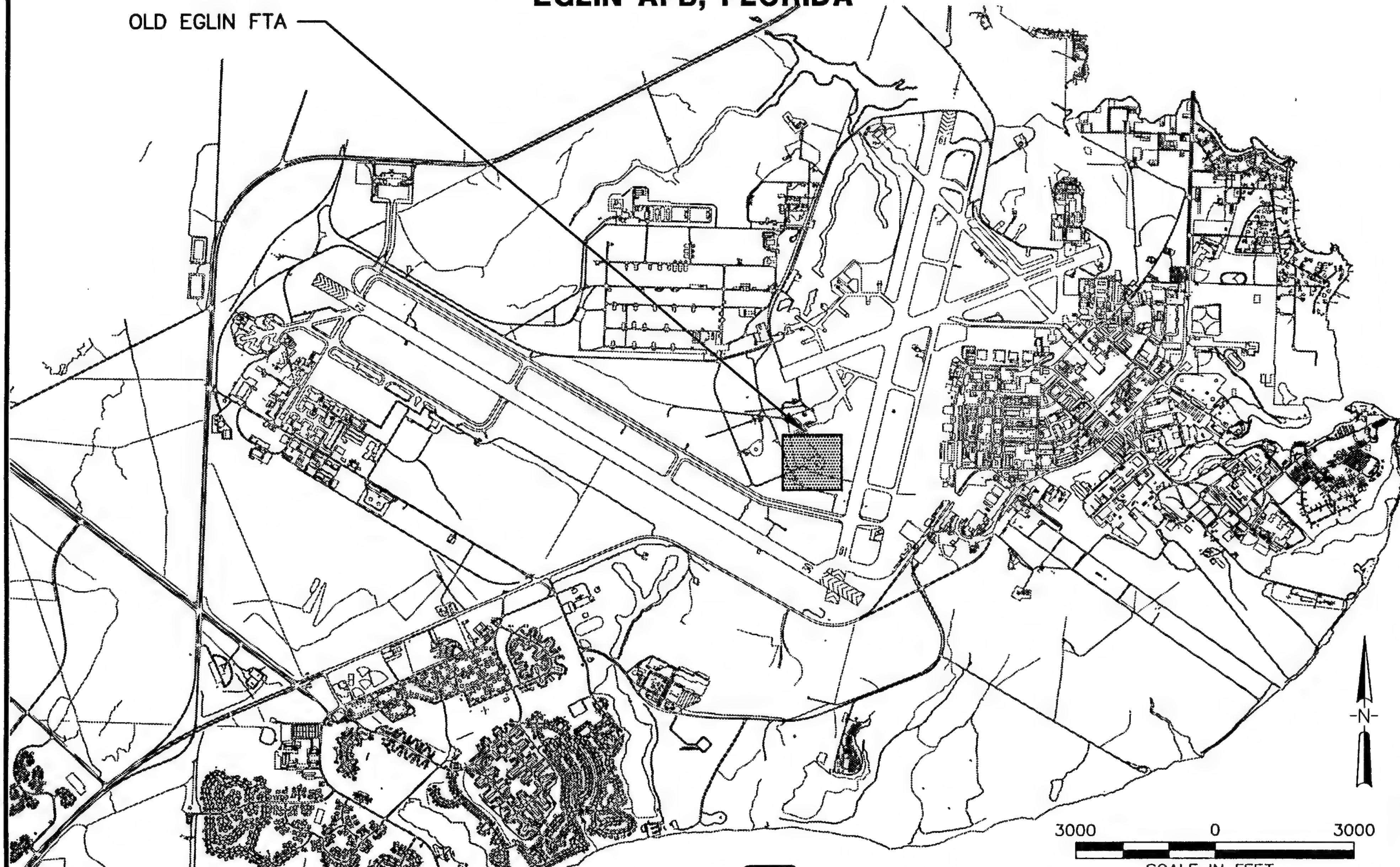
The old Eglin FTA is defined by a large, circular area clear of vegetation, approximately 300 feet across covered by a clay surface (Figure 2.2). The training area is surrounded by an earthen berm measuring less than 12 inches high. The burn pit (located in the center of the training area) is currently inactive and measures approximately 75 feet in diameter with a partially intact 6-inch earthen berm along the periphery for fuel containment. No subsurface liner exists to collect residual fuels, water, and AFFF (an extinguishing agent) used at the site. Two smaller burn areas are located to the northwest of the primary burn area and outside the clay apron. These two areas are on opposite sides of the access road. The westernmost area consists of a collection of old burn drums. The second area is approximately 100 feet east of Building No. 910 and has been used for mixing molten metal fragments and miscellaneous burn debris with surface soil. The remnants of a former AST and unlined containment area are located approximately 225 feet south/southwest of the primary burn pit.

2.3 OPERATIONAL HISTORY

The old Eglin FTA site was used for the training of personnel in the suppression of fires associated with aircraft accidents. The site was active from the 1950s to the late 1970s or early 1980s. During the 1950s and 1960s, a variety of flammable liquids including waste fuel, waste oil, and contaminated fuel were used for fires. Training exercises were conducted as frequently as two to three fires per week. Due to pollution concerns in early 1970s, training exercises became less frequent and the quantities and types of fuels used were reduced. Fire extinguishing agents were limited to primarily water.

Figure 2.1

SITE LOCATION MAP
EGLIN MAIN BASE OLD FTA (FT-28)
EGLIN AFB, FLORIDA

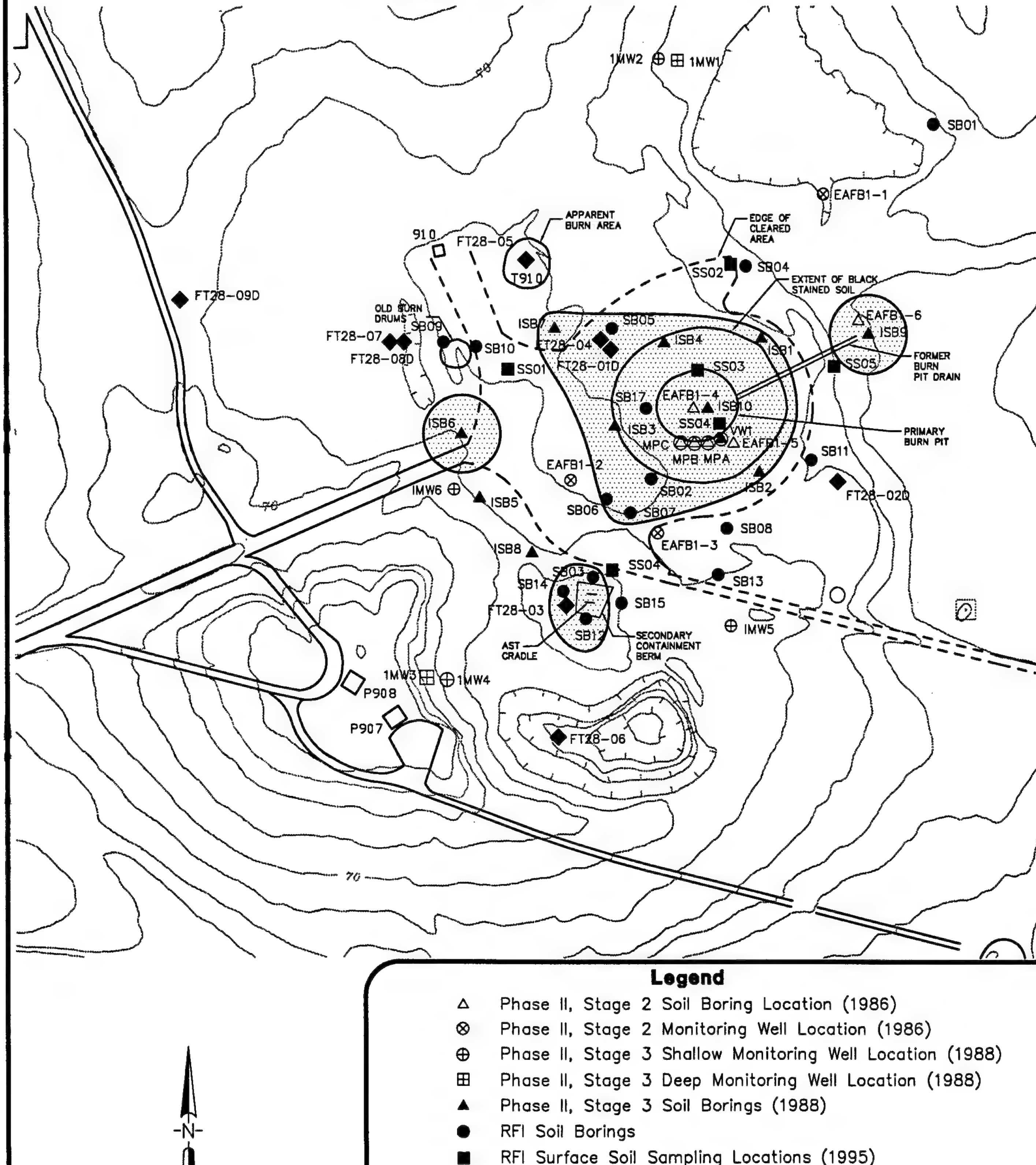


B:\Jobs\726876\Cadd\siteloc, 05/14/97 at 13:27

PARSONS ENGINEERING SCIENCE, INC.

Figure 2.2

Site Layout Map
Eglin Main Base Old FTA (FT-28)
Eglin AFB, Florida



Legend

- Phase II, Stage 2 Soil Boring Location (1986)
- Phase II, Stage 2 Monitoring Well Location (1986)
- Phase II, Stage 3 Shallow Monitoring Well Location (1988)
- Phase II, Stage 3 Deep Monitoring Well Location (1988)
- Phase II, Stage 3 Soil Borings (1988)
- RFI Soil Borings
- RFI Surface Soil Sampling Locations (1995)
- RFI Monitoring Well Locations (1995)
- Bioventing Vent Well
- Bioventing Vapor Monitoring Point
- Contour Interval = 2 Feet
- Extent of Soil and Soil Gas Contamination

N

180 0 180

Scale in Feet

B:\Jobs\726876\Cadd\sitelay, 05/28/97 at 12:44

PARSONS ENGINEERING SCIENCE, INC.

The common practice used during training exercises involved transferring flammable liquids to the burn pit via tanker truck or buried pipe from the AST. The flammable liquid was then sprayed onto a representative mock plane located in the center of the burn pit. Since the burn pit was equipped with an earthen berm, much of the fuel remained confined and was easily ignited. After a specified time, chemicals (AFFF and/or water) were applied to extinguish the fire. Any residual fuel flowed through a buried drain pipe to a small unlined depression east of the training area and was allowed to seep into the soil or evaporate.

2.4 SITE GEOLOGY AND HYDROGEOLOGY

Three predominant geologic features underlie the old Eglin FTA: the sand-and-gravel aquifer, the Pensacola Clay formation, and the limestones comprising the Floridan aquifer system. The surficial sands and gravels extend to an approximate depth of 100 feet bls. The underlying Pensacola Clay is approximately 400 feet thick in the area and extends to a depth of approximately 500 feet bls (O'Brien & Gere, 1995). Groundwater is encountered at seasonally fluctuating depths of approximately 38 to 47 feet bls.

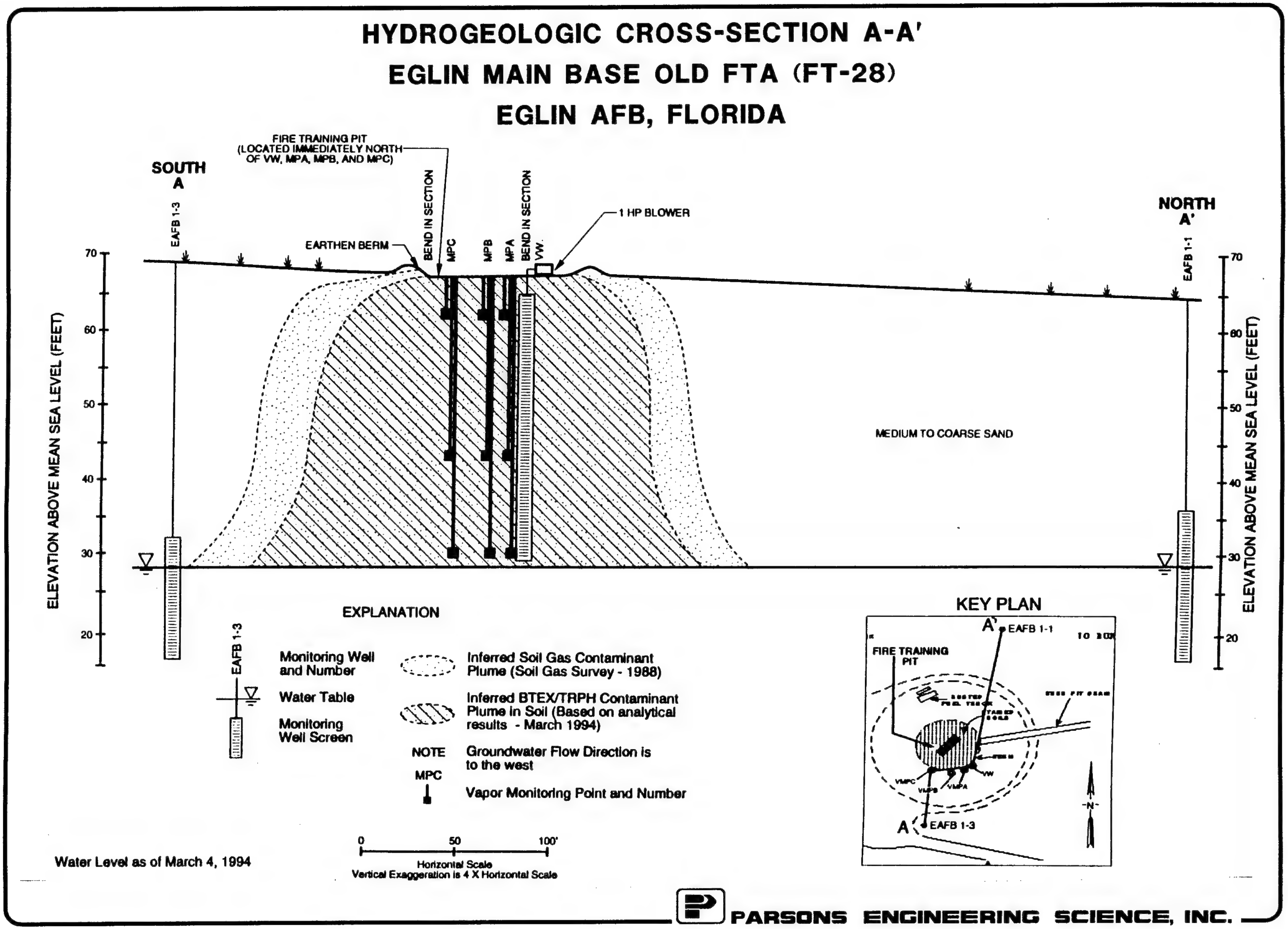
Soils at this site, to a depth of 100 feet bls, consist of predominantly unconsolidated, subrounded, poorly sorted, very fine to very coarse grained quartz sand which becomes finer grained with increasing depth from the land surface (O'Brien & Gere, 1995). During installation of the bioventing VW and MPs, poorly to well graded sand containing intermittent traces of silt and gravel was encountered throughout the unsaturated zone to the top of the water table (approximately 39 feet bls). The generally homogeneous, sandy material at this site is well suited to bioventing treatment, as was demonstrated during the initial 1-year bioventing pilot test.

The sand-and-gravel aquifer occurs under unconfined or water table conditions at the site. The generalized groundwater flow direction in the surficial aquifer is radially outward between north and southwest from the primary burn pit as indicated by past groundwater levels in monitoring wells at the site (O'Brien & Gere, 1995). Near the former AST area, shallow groundwater flow is generally to the southwest. A hydrogeologic cross section of the upper 50 feet of subsurface soils and inferred extent of soil and soil gas contamination at the old Eglin FTA is depicted in Figure 2.3.

2.5 PREVIOUS INVESTIGATIONS

2.5.1 IRP Phase I Investigation

The IRP Phase I investigation was conducted by ES in 1981 to identify the potential for environmental contamination from past waste use and disposal at inactive and active facilities at Eglin AFB. The old Eglin FTA was identified as a potential source for environmental contamination in the investigation. However, the site was not ranked as a high priority for further evaluation (ES, 1981).


HYDROGEOLOGIC CROSS-SECTION A-A'
EGLIN MAIN BASE OLD FTA (FT-28)
EGLIN AFB, FLORIDA
FIRE TRAINING PIT (LOCATED IMMEDIATELY NORTH OF VW, MPA, MPB, AND MPC)
SOUTH A
NORTH A'
EAFB 1-3
EAFB 1-1
EARTHEN BERM
BEND IN SECTION
MPC
MPB
MPA
BEND IN SECTION
VW.
1 HP BLOWER
MEDIUM TO COARSE SAND
ELEVATION ABOVE MEAN SEA LEVEL (FEET)
70
60
50
40
30
20
EXPLANATION
Monitoring Well and Number
Water Table
Monitoring Well Screen
Inferred Soil Gas Contaminant Plume (Soil Gas Survey - 1988)
Inferred BTEX/TRPH Contaminant Plume in Soil (Based on analytical results - March 1994)
NOTE
Groundwater Flow Direction is to the west
Vapor Monitoring Point and Number
0
50
100'
Horizontal Scale
Vertical Exaggeration is 4 X Horizontal Scale
Water Level as of March 4, 1994
KEY PLAN
FIRE TRAINING PIT
VMPC
VMPB
VMPA
VW
-N-
PARSONS ENGINEERING SCIENCE, INC.

2.5.2 IRP Phase II Stage 2 Investigation

Even though the site was not ranked as a high priority in the Phase I investigation, the site was included in the IRP Phase II, Stage 2 investigation at the request of the Air Force Systems Command (ES, 1988). The investigation included drilling six soil borings (EAFB1-1 through EAFB1-6), converting three of the borings to monitoring wells (EAFB1-1 through EAFB1-3) and collecting groundwater samples from the wells. Each of the borings was approximately 50 feet in depth. The monitoring wells were installed around the periphery of the site as shown in Figure 2.2. Each of the wells was approximately 50 feet deep and installed in the water table aquifer. Static groundwater level measurements indicated the surficial groundwater flow direction was generally south/southeast toward the intersection of the North-South and East-West runways.

Boring EAFB1-6 was installed at the discharge point of residual fluids to the depression east of the training area. Boring EAFB1-1 through EAFB1-5 were advanced either along the perimeter of the site or within the clay surface. Soil samples were collected during drilling of each boring for visual inspection of petroleum contamination. Four of the six boring samples (EAFB1-3, EAFB1-4, EAFB1-5, and EAFB1-6) displayed stained soil and/or exhibited strong fuel odors throughout depth. Chemical analyses were not performed on soil samples during this field effort.

2.5.3 IRP Phase II Stage 3 Investigation

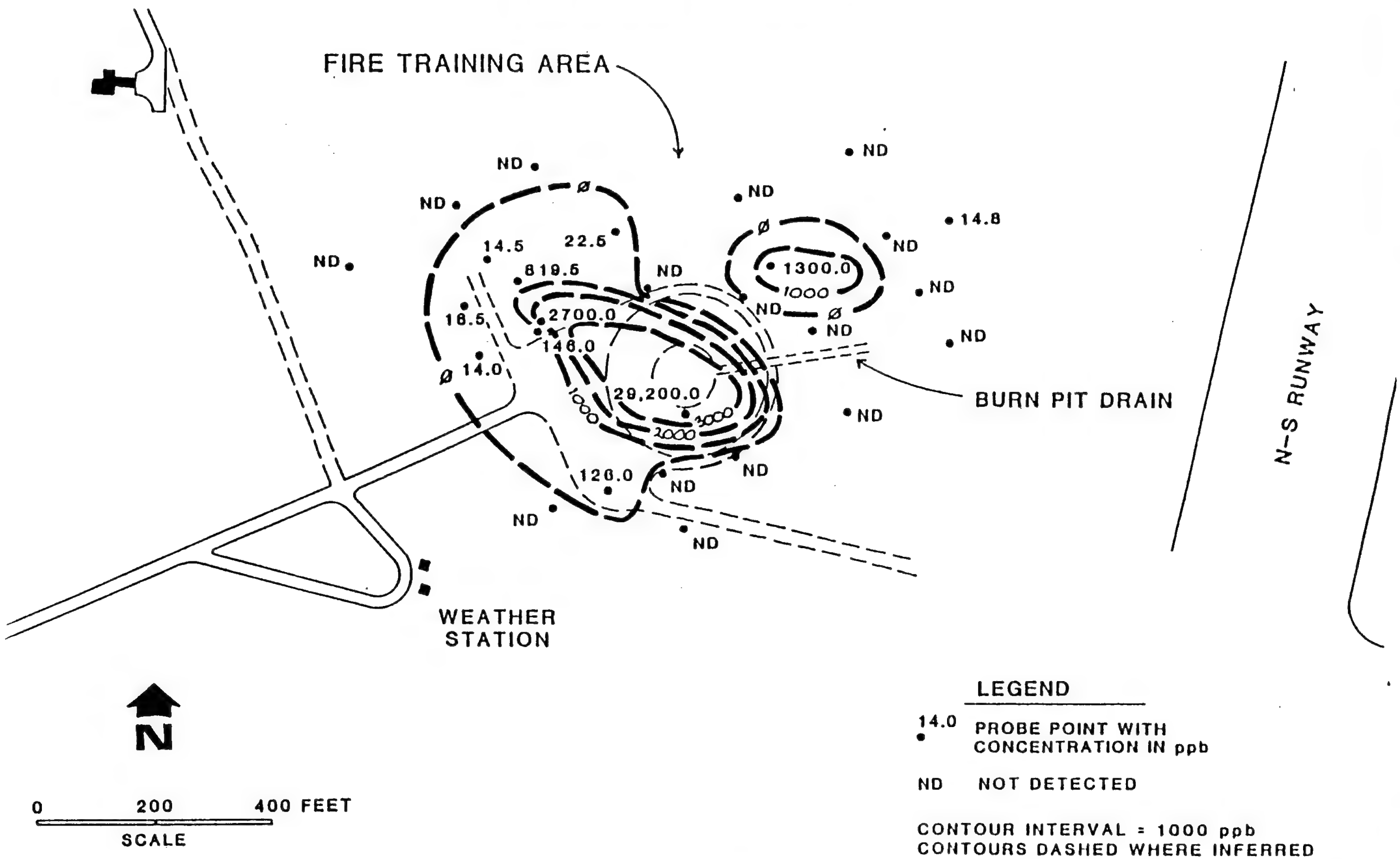
The IRP Phase II, Stage 3 field effort began in March 1988 and was designed to obtain additional data to further characterize the site. A soil gas survey was conducted to aid in soil boring and well sitings. This information was used to advance nine soil borings (1SB1 through 1SB9) to the soil-water interface and install six monitoring wells (1MW1, 1MW2, 1MW3, 1MW4, 1MW5, and 1MW6). Monitoring wells 1MW1 and 1MW3 were installed as four inch diameter deep wells (advanced to 100 feet bls). In addition to the sampling of the new monitoring wells, groundwater samples also were collected from the three previously-installed monitoring wells. The locations of the borings and monitoring wells installed during this investigation are presented in Figure 2.2.

The soil gas survey identified the presence of benzene, toluene, and trichloroethene (TCE). Chlorobenzene and xylenes were also detected. Benzene concentrations ranged from non-detect to 29.2 parts per million, volume per volume (ppmv); toluene concentrations ranged from non-detect to 5.8 ppmv; and TCE concentrations ranged from non-detect to 2.9 ppmv. The distribution of these three compounds were very similar with the highest concentrations found beneath the primary burn pit and near the topographic low northwest of the burn pit where rainwater runoff accumulates near 1SB7. The distribution of benzene in the soil gas is presented in Figure 2.4.

Total petroleum hydrocarbons (TPH) concentrations were detected in samples collected from 7 of 10 soil borings at concentrations ranging from 110 milligrams per kilogram (mg/kg) to 11,000 mg/kg. The highest concentration was from the boring

Figure 2.4

ISOCONCENTRATIONS OF BENZENE IN SOIL GAS
EGLIN MAIN BASE OLD FTA (FT-28)
EGLIN AFB, FLORIDA



B:\Jobs\726876\Cadd\oldegfta\FIG2-4, 05/14/97 at 09:49

PARSONS ENGINEERING SCIENCE, INC.

advanced in the center of the burn pit (1SB10). Three samples were collected from this boring up to a depth of 14 feet bls. The concentrations of TPH were comparable for all three samples regardless of depth. A soil boring advanced near the location of 1SB10 during the IRP Phase II, Stage 2 investigation was not sampled but fuel odor was noted throughout the boring depth to the water table.

TPH concentrations were detected in the shallow samples only (less than 9 feet bls) in five of the other six borings (1SB1, 1SB2, 1SB3, 1SB4, and 1SB9) from which samples contained TPH. Samples collected at the water table for these samples were non-detect for TPH. Soil boring 1SB6, located west of the training area, showed an increase in TPH concentration with depth ranging from 520 mg/kg at 5 feet bls to 2200 mg/kg at the water table.

Total BTEX concentrations were detected from five borings at depths less than 20 feet bls ranging from approximately 10.5 mg/kg (1SB6) to 41,000 mg/kg (1SB4). Boring 1SB2, located southeast or the burn pit and within the clay area, was the only boring for which BTEX was detected at the water table. The BTEX concentration detected was approximately 21 mg/kg. With the exception of a BTEX concentration of approximately 250 mg/kg at a sampling depth of 16.5 feet bls from 1SB7, all soil samples from soil borings 1SB5, 1SB7, and 1SB8 were free of detectable petroleum hydrocarbon contamination.

2.5.4 Pilot-Scale Bioventing System Installation and Testing

In March 1994, a pilot-scale bioventing system was installed at the site to evaluate the effectiveness of this technology to reduce hydrocarbon concentrations in the vadose zone soils. During installation of the pilot test bioventing system, significant evidence of soil contamination (strong petroleum odor, staining, and elevated photoionization detector [PID] and total hydrocarbon readings) was observed at the boreholes for the VW and MPs. The inferred extent of soil and soil gas contamination based on previous investigation results and the bioventing pilot test soil and soil gas analyses is depicted in Figure 2.2. Details on the pilot test results are presented in Section 3.

2.5.5 RCRA Facility Investigation

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was performed by O'Brien and Gere in 1995. The RFI field effort began in March 1994 and was designed to define the extent of site contamination (O'Brien & Gere, 1995). A second soil gas survey was conducted, surface and subsurface soils were collected, and six additional monitoring wells were installed. The BTEX, TPH, phenanthrene, and 2-methylnapthalene results from this investigation are provided in Table 2.1.

2 SS-04 no SS-06

Six surface soil samples (SS01 through SS06) were ~~collected~~ within the clay area and around the perimeter of the training area (Figure 2.2). No volatile organic compounds (VOCs) or fuel-related semi-volatile organic compounds (SVOCs) were detected in any of the samples.

TABLE 2.1
BTEX, 2-Methylnaphthalene, Phenanthrene, and TPH Concentrations Detected in Soil
Old Eglin FTA - (Site FT-28)
Eglin AFB, Florida

Sampling Location	Depth (feet, bgs)	TPH (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	2-Methylnaphthalene (mg/kg)	Phenanthrene (mg/kg)
SB01	32	NA	0.0028U	0.0028U	0.0028U	0.0028U	0.18U	0.18U
SB01	36	NA	0.0029U	**0.001J**	0.0029U	0.0029U	0.18U	0.18U
SB01	42	NA	0.0029U	**0.0014J**	0.0029U	0.0029U	0.19U	0.19U
SB02	28	NA	0.0026U	0.0026U	0.0026U	0.0026U	0.17U	0.17U
SB02	34	NA	**0.0026J**	0.0028U	**0.0013J**	**0.0006J**	0.18U	0.18U
SB02	42	NA	0.0029U	0.0029U	0.0029U	0.0029U	0.19U	0.19U
SB03	28	NA	0.013U	**0.0171**	**0.084**	**0.096**	**10.2**	1.71U
SB03	34	NA	0.33U	**0.3078J**	**1.89**	**11.6**	**12.3H**	1.69U
SB03	50	NA	0.36U	**0.2872J**	**0.4113**	**2.1**	**8.8**	0.36U
SB04	4	NA	0.0026U	0.0026U	0.0026U	0.0026U	1.7U	1.7U
SB04	32	NA	0.003U	0.003U	0.003U	0.003U	0.19U	0.19U
SB04	38	NA	0.0029U	0.0029U	0.0029U	0.0029U	0.19U	0.19U
SB05	4	NA	1.3U	1.3U	**2.4**	**11**	**1.99**	**0.5584**
SB05	30	NA	0.0025U	0.0025U	0.0025U	0.0025U	0.16U	0.16U
SB05	42	NA	**0.0056**	0.0029U	**0.0039**	**0.0301**	0.18U	0.18U
SB06	20	NA	0.013U	0.013U	**0.17**	**0.41**	**11**	0.33U
SB06	38	NA	**0.0012J**	**0.0008J**	**0.0014J**	**0.0031**	0.18U	0.18U
SB06	44	NA	**0.0218**	0.0029U	**0.023**	**0.1003**	0.19U	0.19U
SB07	36	NA	0.33U	0.33U	**1.08**	**7**	**0.53**	0.17U
SB07	38	NA	0.38U	0.36U	**6.51**	**41.8**	**7.39**	0.37U
SB07	46	NA	0.03U	0.03U	**0.0388J**	**0.219**	0.19U	0.19U
SB08	32	NA	0.0028U	0.0028U	0.0028U	0.0028U	0.18U	0.18U
SB08	36	NA	0.003U	**0.0011J**	0.003U	0.003U	0.19U	0.19U
SB08	42	NA	0.0029U	0.0029U	0.0029U	0.0029U	0.19U	0.19U
SB09	22	NA	0.0026U	0.0026U	0.0026U	0.0026U	0.16U	0.16U
SB09	32	NA	0.0028U	0.0028U	0.0028U	0.0028U	0.18U	0.18U
SB09	40	NA	NA	NA	NA	NA	0.18U	0.18U
SB10	32	NA	0.0025U	0.0025U	0.0025U	0.0025U	0.16U	0.16U
SB10	34	NA	0.0027U	0.0027U	0.0027U	0.0027U	0.17U	0.17U
SB10	42	NA	0.0029U	0.0029U	0.0029U	0.0029U	0.18U	0.18U
SB11	32	NA	0.0029U	0.0029U	0.0029U	0.0029U	0.19U	0.19U
SB11	36	NA	0.003U	**0.0018J**	0.003U	0.003U	0.19U	0.19U
SB11	42	NA	0.003U	0.003U	0.003U	0.003U	0.19U	0.19U
SB12	36	NA	0.35U	**0.6335**	**1.52**	**11.4**	**1.43**	0.18U
SB12	44	NA	**11**	**69.6**	**51.2**	**302**	**78.3**	0.19U
SB12	50	NA	**4.94**	**40.7**	**25.7**	**133**	**29.4**	0.19U
SB13	32	NA	0.0027U	**0.0011J**	0.0027U	0.0027U	0.17U	0.17U
SB13	36	NA	0.003U	0.003U	0.003U	0.003U	0.19U	0.19U
SB13	42	NA	0.0027U	0.0027U	0.0027U	0.0027U	0.17U	0.17U
SB14	28	ND	0.0026U	0.0026U	0.0026U	0.0026U	0.169U	0.169U
SB14	32	ND	0.0026U	0.0026U	0.0026U	**0.0012J**	0.169U	0.169U
SB14	34	**102**	0.0026U	0.0026U	0.0026U	**0.0017J**	0.167U	0.167U
SB15	24	ND	0.0027U	0.0027U	0.0027U	0.0027U	0.173U	0.173U
SB15	32	ND	0.0027U	0.0027U	0.0027U	0.0027U	0.171U	0.171U
SB15	34	ND	0.0028U	0.0028U	0.0028U	0.0028U	0.179U	0.179U
SB17	4	NA	**0.25**	ND	**6.6**	**6.1**	**22**	**1.8**
SB17	42	NA	**0.0007J**	ND	0.0023U	0.0023U	0.18U	0.18U

.003 .12 .12 .11

Notes:
bgs - below ground surface.
mg/kg - milligrams per kilogram.
BTEX compounds were analyzed using Method SW8260
H - Biased High NA - Not Analyzed. J - Estimated value.
U - Not detected above laboratory reporting limits.
ND - Not Detected. Laboratory reporting limit not available.
Source: O' Brien & Gere, Old Eglin FTA Site FT-28 RFI, 1995

Bold?

N:\726876\ENG\OLDFTARAP\T-2-1.XLS

Fifteen soil borings (SB01 through SB15) were advanced based on the results of the soil gas survey (Figure 2.2). Petroleum related compounds including benzene, ethylbenzene, toluene, and xylenes were detected throughout the soil column with the higher concentrations near the water table. The maximum BTEX concentration was detected at the water table from SB12, located south of the former AST area, at a concentration of approximately 433 mg/kg. Napthalene and other components of fuel oil were detected at depth from soil boring samples near the former AST area. However, no VOCs or fuel-related SVOCs were detected above screening levels in any of the samples.

An additional soil boring (SB17) was advanced in April 1996 on the west side of the burn pit within an area of observed black-stained soil. Total BTEX compounds detected in shallow soil (2 to 4 feet bls) were approximately 13 mg/kg. The SVOC 2-methylnapthalene was detected at 22 mg/kg. The concentrations of benzene (0.25 mg/kg), ethylbenzene (6.6 mg/kg), and xylenes (6.1 mg/kg) exceeded the applicable FDEP Soil Cleanup Goals (Table 2.2). Ten hand auger borings were also completed to depths of up to 5 feet bls in May 1996 to determine the extent of the black stained soils surrounding the primary burn pit. The extent of heavily stained soils was determined through visual inspection and headspace measurements of hand auger samples using a flame ionization detector (FID) (O'brien and Gere, 1996a). The extent of heavily stained soils is presented on Figure 2.2.

No BTEX compounds were detected above the applicable FDEP Soil Cleanup Goals in the soil sample collected from the water table. The SVOC 2-methylnaphthalene was not detected at depth.

2.5.6 RCRA Corrective Measures Study

The RFI and subsequent risk assessment concluded that hypothetical future risks to adult and child residents are primarily associated with ingestion of contaminated groundwater, inhalation of VOCs in groundwater through showering, and dermal contact with groundwater through showering (O'Brien & Gere, 1995). The RFI indicated contaminants currently present in surface and subsurface soil are a continued source of groundwater contamination.

A RCRA Corrective Measures Study (CMS) was performed by O'Brien and Gere in 1996. The CMS was based on the results of previous investigations and the 1995 RFI. The selected remediation alternative included modification of the existing bioventing system to continue *in situ* treatment of soil near the burn pit and extension to the AST area.

2.5.7 Investigation Summary

Field observations, field screening results, and soil and soil gas analytical results indicate that the majority of the site soils are contaminated throughout the soil column to the water table. However, the highest concentrations of contaminants near the burn pit are located in the shallow soil horizon (1 to 4 feet bls). This indicates that fuel residuals released at the site not only migrated vertically to the groundwater surface but also

spread horizontally as they moved vertically. Fluctuating groundwater table elevations may also have caused a smearing of petroleum hydrocarbons in soils near the water table.

A soil gas survey conducted in 1988 identified the presence of benzene, toluene, and TCE in the soil gas beneath the burn pit toward topographic low to the northwest where rainwater runoff accumulates. The most recent soil sample results collected during the RFI in 1995 indicated that benzene, ethylbenzene, toluene and xylenes were present at maximum concentrations of 11 mg/kg, 51.2 mg/kg, 69.6 mg/kg, and 302 mg/kg, respectively. TCE was not detected. Soil samples collected from within the radius of influence of the existing VW after 12 months of bioventing indicated remediation of BTEX to near non detectable concentrations.

The remaining contaminated areas are outside the radius of influence of the existing pilot-scale bioventing system. The proposed upgrade to the bioventing pilot system is designed to provide the necessary oxygen and stimulate *in situ* biodegradation throughout the remaining contaminated soil.

2.6 REGULATORY INTERPRETATION

The Florida Department of Environmental Protection (FDEP) has established a list of risk-based soil cleanup goals for a variety of chemicals. These goals are not enforceable cleanup standards but serve as guidance to aid in making cleanup decisions (FDEP, 1995). Soil cleanup goals for residential and industrial scenarios are listed and are applicable to soils from the ground surface to two feet bls. For soils below two feet bls, leachability-based goals are also provided. Historically, the maximum BTEX concentrations were detected in samples collected from the water table (Table 2.1); therefore, the leachability-based goals apply. The applicable soil cleanup goals are presented in Table 2.2. Based on the 1995 RFI soil results, benzene, ethylbenzene, and xylene compounds are present at concentrations above the applicable soil cleanup goals. In addition, phenanthrene, methylnapthalene and TPH were considered contaminants of concern and no cleanup levels have been established for these compounds (O'Brien & Gere, 1995). The proposed system upgrade would provide an effective remedial alternative to reduce the BTEX concentrations to below cleanup goals and reduce the concentrations of phenanthrene, methylnapthalene, and TPH.

TABLE 2.2
Applicable FDEP Soil Cleanup Goals
Old Eglin FTA - (Site FT-28)
Eglin AFB, Florida

Chemical	Soil Cleanup Goal[/a] (mg/kg)[/c]	Maximum Detected Concentration[/b] (mg/kg)
Benzene	0.003	11
Ethylbenzene	0.2	51.2
Toluene	0.2	69.6
Xylenes	0.1	302
Phenanthrene	-	1.8
2-Methylnaphthalene	-	78.3

Notes:
/a - Leachability-Based Goals (FDEP, 1995)
/b - Using the RFI analytical results (O'Brien and Gere, 1995).
/c - mg/kg - milligrams per kilogram.

3. BIOVENTING PILOT TEST RESULTS

A bioventing pilot test was performed by Parsons ES at the old Eglin FTA from July 1994 through July 1995. The objectives of the initial bioventing pilot test were to:

- Assess the potential for supplying oxygen throughout the contaminated soil interval;
- To determine the rate at which indigenous microorganisms will degrade fuel when stimulated by oxygen-rich soil gas at this site; and
- To evaluate the potential for sustaining these rates of biodegradation until fuel contamination is remediated below regulatory approved standards.

Because bioventing has been demonstrated to be a feasible technology for this site, the pilot test data were used to design a full-scale remediation system (Section 4) to remediate the soils at the site, minimize potential releases to groundwater/surface water, and lower contaminant concentrations throughout the site to below regulatory standards.

Based on the results from the soil gas survey conducted as part of the IRP Phase II Stage III Investigation, a VW and three MPs were installed along the southern edge of the primary burn pit. The VW was installed to facilitate the injection of ambient air into the vadose zone. The MPs were installed to monitor the *in situ* biodegradation rates, as well as to determine the radius of oxygen influence of the VW. The locations of the VW, MPs, and blower are presented in Figure 2.1. Figure 2.2 depicts the hydrogeologic cross section at the old Eglin FTA and provides a profile of the bioventing system.

3.1 SYSTEM CONSTRUCTION

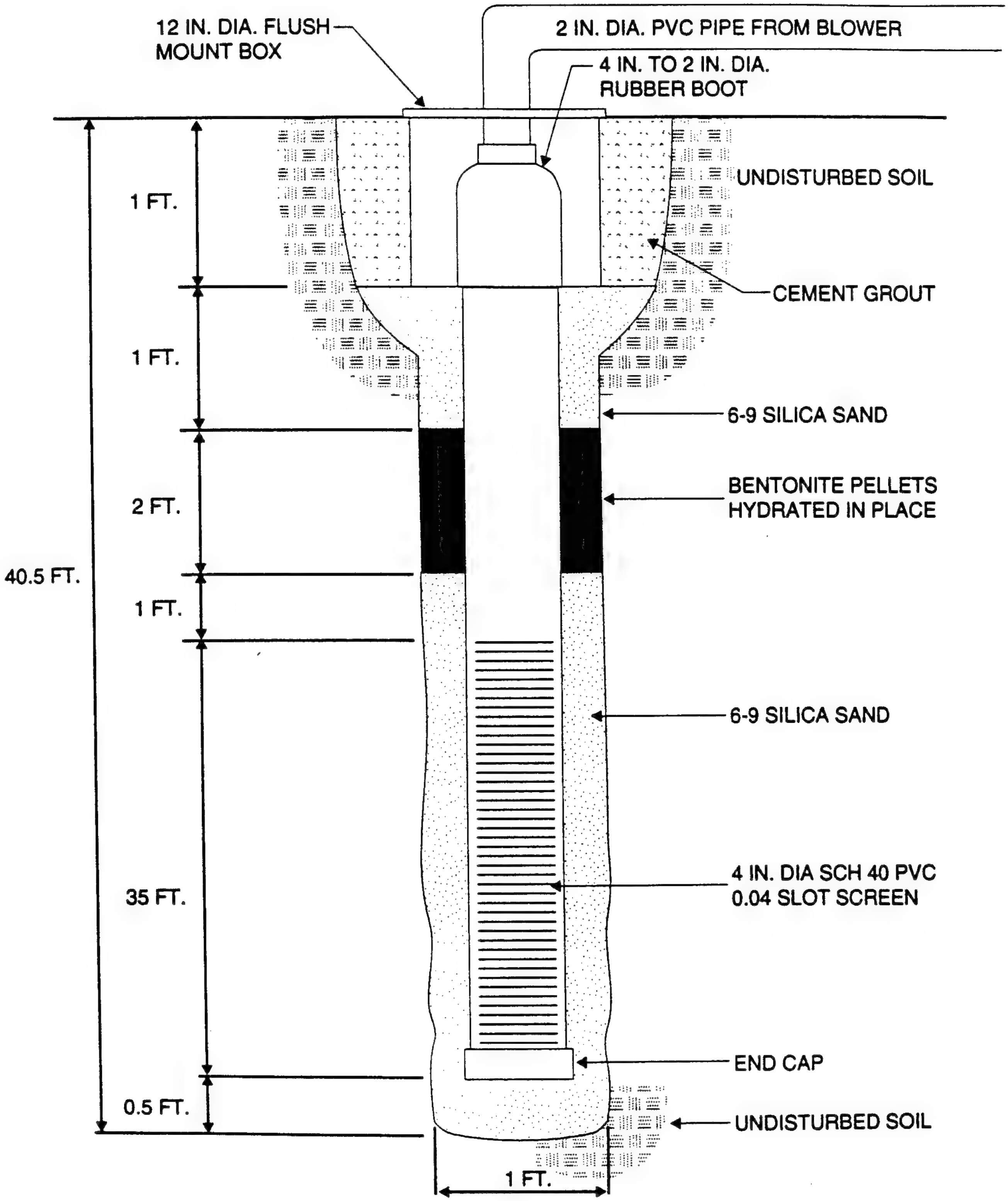
3.1.1 VW Construction

The VW was installed on March 1, 1994, and was constructed of 4-inch diameter Schedule 40 PVC with a slot size of 0.04 inches. The total depth of the VW was 40 feet bls, with a screened interval from 5 to 40 feet bls. A construction detail of the VW is presented on Figure 3.1.

3.1.2 Soil Vapor Monitoring Points

Three soil MPs were installed at 10, 20 and 40 feet radially away from the air injection VW. Each MP was constructed to provide multiple depth soil gas monitoring with three discrete sample points at 4.5 to 5 feet, 25.5 to 26 feet, and 38.5 to 39 feet bls. Each discrete point was constructed of a 6-inch long piece of 1/2-inch inner diameter (ID) Schedule 40 PVC well screen with 0.02 slot size. The riser of each discrete point was constructed of 1/2-inch ID Schedule 80 PVC, which extended to approximately six inches bls.

INJECTION VENT WELL CONSTRUCTION DETAIL
EGLIN MAIN BASE OLD FTA - (SITE FT-28)
EGLIN AFB, FLORIDA



NOT TO SCALE

B:\Jobs\726876\Cadd\oldegfta\FIG3-1, 05/14/97 at 09:50

PARSONS ENGINEERING SCIENCE, INC.

Additionally, Type K thermocouples with mini connectors were installed at the 39 feet and 5 feet bls discrete monitoring points in the MP closest to the VW (MPA). These thermocouples were installed to measure the temperature profile at the site. The top of each MP was completed with a 12-inch-diameter flush mounted protective well cover set in a concrete base. Figure 3.2 shows the construction of the soil MP.

3.1.3 Blower Unit Installation

A one-horsepower Gast® regenerative blower unit was installed at the site for the initial and extended pilot tests. The blower was installed in a weather-resistant enclosure and electrically wired for permanent 240-volt, single-phase, 30-amp service. Air from the blower is injected into the VW via a 2-inch-diameter PVC line connected to the blower's exhaust port. At the time of installation, the blower unit was injecting air at approximately 92 cubic feet per minute (cfm).

3.2 PILOT TEST SOIL AND SOIL GAS SAMPLING RESULTS

3.2.1 Soil and Soil Gas Sampling Results

Hydrocarbon contamination at the site appears to extend from the ground surface to the groundwater table. However, at depths between 15 and 30 feet bls evidence of contamination was minimal. Contaminated soils collected by split spoons during the VW and MP installations were identified based on visual appearance, odor and PID screening. Varying degrees of hydrocarbon staining were encountered throughout the vertical profile in the unsaturated soil zone, and light to strong hydrocarbon odors were noticed in nearly all the split spoon samples. PID readings of greater than 20,000 ppmv were measured in a number of soil samples.

Soil gas samples were collected, prior to performing the air permeability test, in laboratory provided, evacuated Summa® canisters. Soil gas samples were collected from the VW, the 4.5 to 5 feet bls discrete monitoring point at MPA, and from the 38.5 to 39 feet bls discrete monitoring point in MPC. All soil gas samples were collected following procedures in the Protocol Document (Hinchee et al, 1992; Downey and Hall, 1994).

Each soil sample was analyzed for TRPH; BTEX; iron; alkalinity; total Kjeldahl nitrogen (TKN); pH; phosphates; percent moisture; and grain size distribution. Soil gas samples were placed in a shipping box (without ice), and shipped via Federal Express® to Air Toxics, Inc., in Folsom, CA for TVH and BTEX analysis. The analytical results for these soil and soil gas samples are presented in Table 3.1.

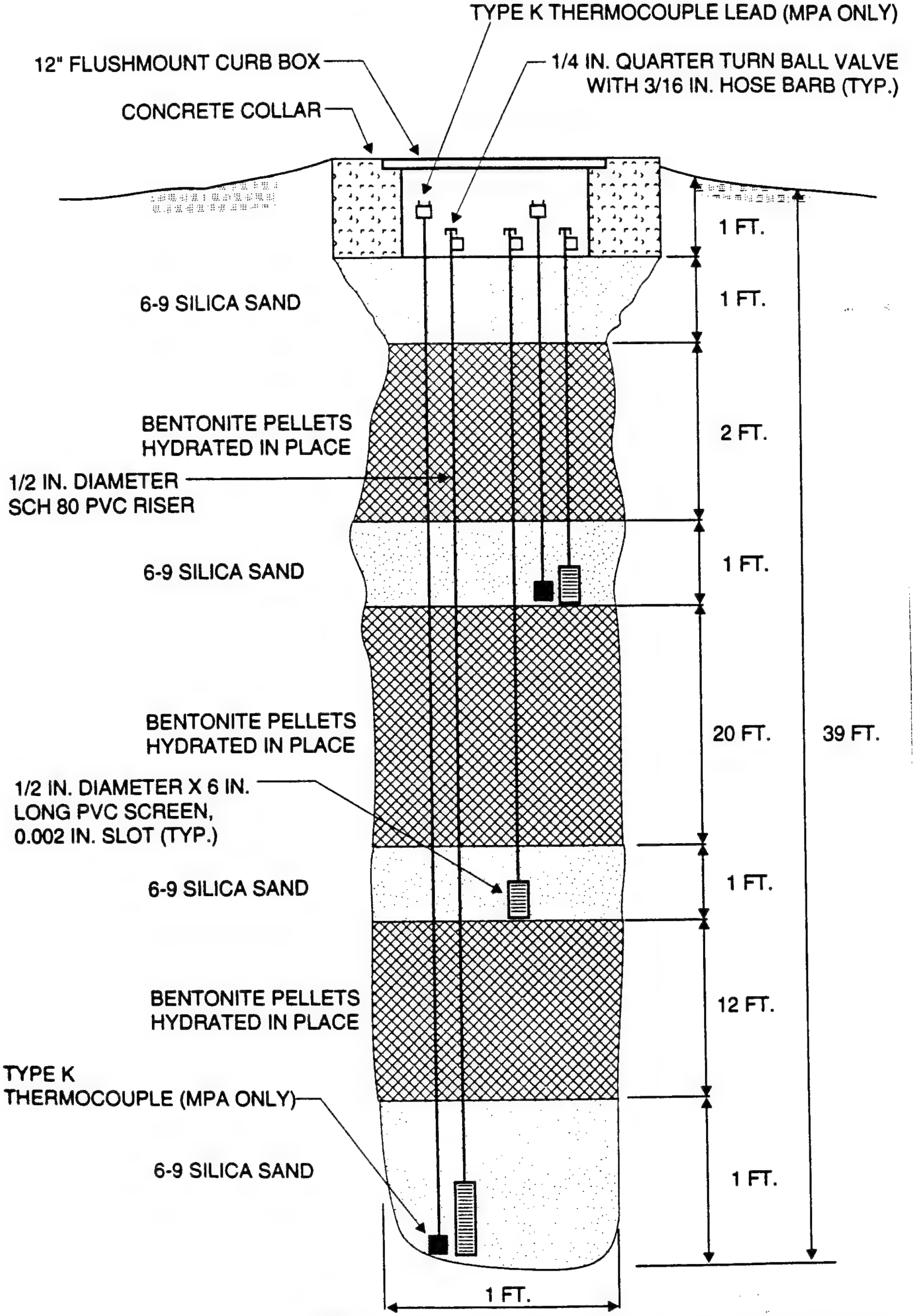
3.3 PILOT TEST RESULTS

3.3.1 Initial Test

3.3.1.1 Initial Soil Gas Chemistry

Prior to initiating any air injection, soil gas in the VW and all MPs was sampled for TVH, oxygen, and carbon dioxide. Oxygen depletion was measured around the burn pit. The results of the initial monitoring is presented in Table 3.2.

VAPOR MONITORING POINT CONSTRUCTION DETAIL
EGLIN MAIN BASE OLD FTA - (SITE FT-28)
EGLIN AFB, FLORIDA



B:\Jobs\726876\Cadd\oldegfta\FIG3-2, 05/14/97 at 09:51

PARSONS ENGINEERING SCIENCE, INC.

TABLE 3.1
INITIAL AND 1-YEAR SOIL AND SOIL GAS ANALYTICAL RESULTS
EGLIN MAIN BASE OLD FTA (FT-28)
EGLIN AFB, FLORIDA

Analyte (Units) [a]	Sample Locations-Depth (feet below ground surface)					
	EG2-VW		EG2-MPA-4.5-5		EG2-MPC-38.5-39	
Soil Gas Hydrocarbons	Initial [b]	1-Year [c]	Initial	1-Year	Initial	1-Year [d]
TVH (ppmv)	11,000	1.6	11,000	79	26,000	10
Benzene (ppmv)	94	0.002	93	0.13	250	0.034
Toluene (ppmv)	52	0.004	24	0.037	460	0.012
Ethylbenzene (ppmv)	20	<0.002	20	0.016	47	0.025
Xylenes (ppmv)	76	<0.002	64	0.094	220	0.09
	EG2-VW-3-5		EG2-MPA-33-39 [f]		EG2-MPB-2-4	
Soil Hydrocarbons	Initial [b]	1-Year [e]	Initial	1-Year	Initial	1-Year
TRPH (mg/kg)	2,210	4,500	3,370	70.8	6,610	5,290
Benzene (mg/kg)	10	0.057	0.15	< 0.050	< 2.7	0.14
Toluene (mg/kg)	21	0.11	0.19	0.050	< 2.7	0.26
Ethylbenzene (mg/kg)	24	1.4	0.4	< 0.050	9.9	1.80
Xylenes (mg/kg)	72	< 0.13	2.5	< 0.130	22	2.60
Moisture (%)	6.0	14.0	7.0	18.4	7.6	16.3

[a] TVH=total volatile hydrocarbons: ppmv = parts per million, volume per volume;
TRPH = total recoverable petroleum hydrocarbons; mg/kg = milligrams per kilogram.

[b] Initial soil gas samples collected on March 16, 1994.

[c] Final soil gas samples collected on July 24, 1995. Blower system was shut down approximately 30 days prior to soil gas sampling to allow soil gas to come to equilibrium with soils.

[d] Initial soil samples collected on March 3, 1994.

[e] Final soil samples collected on July 28,1995 for VW and MPB, and on October 20, 1995 for MPA.

[f] Initial soil samples collected at 37-39 feet below ground surface (bgs). 1-Year soil sample collected at 33-34 feet bgs.

As shown in Table 3.2, the VW and all MPs had completely depleted oxygen levels (0.0 percent), high carbon dioxide readings (greater than 10 percent), and TVH readings exceeding 20,000 ppmv. These readings suggest that indigenous microorganisms have completely depleted the naturally available oxygen supply, indicating significant biological activity. In contrast, the background monitoring point (EAFB1-1) indicated near atmospheric conditions in soil gas (i.e. greater than 20 percent oxygen and less than 0.5 percent carbon dioxide) to a depth of at least 35 feet bls.

3.3.1.2 Air Permeability

An air permeability test was conducted according to the Protocol Document procedures on 23 March 1994 (Hinchee et al, 1992; Downey and Hall, 1994). Air was injected into the VW for two and one-half hours at a rate of approximately 92 cfm and an average pressure of 4 inches of water. Steady-state pressure levels were achieved at all MPs in approximately 150 minutes. Table 3.3 provides the maximum steady-state pressures at each discrete monitoring point.

Due to the gradual response and relatively lengthy time to achieve steady-state conditions, the dynamic method of determining soil permeability was selected (Hinchee et al., 1992). Using the HyperVentilate® model, an air permeability value ranging from 77 to 305 darcys was calculated for this site. The air permeability, calculated using the steady-state method, was 70.4 darcys. The radius of pressure influence is estimated to exceed 60 feet.

3.3.1.3 Oxygen Influence

The depth and radius of oxygen influence in the subsurface resulting from air injection into the central VW is the primary design parameter for bioventing systems. Optimization of full-scale and multiple VW systems requires pilot testing to determine the volume of soil that can be oxygenated at a given flow rate and screen configuration.

Based on the oxygen increase and the pressure response observed at all of the monitoring points during the system start-up period, it was estimated that the long-term radius of oxygen influence at the old Eglin FTA will exceed 40 feet when air is injected at a rate of approximately 30 cfm.

3.3.1.4 *In-Situ* Respiration Rates

Initial *in-situ* respiration tests were performed at the following monitoring points and depths: MPA (4.5 to 5 feet bls), MPB (25.5 to 26 feet bls), and MPC (38.5 to 39 feet bls). These points were chosen based on their low oxygen readings (0.0 percent), high carbon dioxide readings (greater than 10 percent), and high TVH readings (greater than 20,000 ppmv. Oxygen utilization rates observed at the site were very consistent and ranged from 0.06 to 0.24 percent per hour.

At old Eglin FTA, an estimated 860 milligrams (mg) of fuel per kilogram of soil can be degraded each year. This value is the average of the fuel consumption rates calculated for every point at which a respiration test was conducted. The interval-

TABLE 3.2
INITIAL SOIL GAS CHEMISTRY
OLD EGLIN FTA (FT-28)
EGLIN AFB, FLORIDA

MP	Screen Interval (ft, bls)	O2 (%)	CO2 (%)	TVH (ppm)
VW	5 - 40	0.0	10.5	20,000+
MPA	4.5 - 5.0	0.0	10.25	20,000+
MPA	25.5 - 26.0	0.0	10.25	20,000+
MPA	38.5 - 39.0	NM	NM	NM
MPB	4.5 - 5.0	0.0	10.25	20,000+
MPB	25.5 - 26.0	0.0	10.25	20,000+
MPB	38.5 - 39.0	0.0	10.5	20,000+
MPC	4.5 - 5.0	0.0	10.75	20,000+
MPC	25.5 - 26.0	0.0	10.5	20,000+
MPC	38.5 - 39.0	0.0	11	20,000+

NM - Not Measured (unable to draw sample) Water or tight soils

TABLE 3.3
MAXIMUM PRESSURE RESPONSE DURING
AIR PERMEABILITY TEST
OLD EGLIN FTA (FT-28)
EGLIN AFB, FLORIDA

	Distance from injection well (VW)								
	10' (MPA)			20' (MPB)			40' (MPC)		
Depth (feet)	4.5	25.5	38.5	4.5	25.5	38.5	4.5	25.5	38.5
Time (minutes)	150	150	-	125	125	-	150	150	150
Max Pressure (inches H_2O)	2.15	2.6	-	1.8	1.77	-	1.4	1.5	1.5

Note: water table may have risen above the screen at the deep monitoring points at MPA and MPB.
Readings could not be obtained at these points.

N:\726876\ENG\OLDFTARAP\T-3-2&3.XLS

specific fuel consumption rates were calculated using observed oxygen utilization rates, estimated air-filled porosities, and a conservative ratio of 3.5 mg of oxygen consumed for every 1 mg of fuel biodegraded. The air-filled porosity calculated for each sampling point ranged from 0.09 to 0.17 liters of air per kilogram of soil.

3.3.1.5 Potential Air Emissions

The long-term potential for air emissions from full-scale bioventing operations at the site were considered to be low because of the age and type of the site contaminants (greater than 5 years, and primarily JP4 jet fuel). Additionally, health and safety monitoring conducted during the permeability test using a PID sensitive to 1 ppmv did not detect any hydrocarbons above background levels in the breathing zone or at the ground surface. Because the potential for air emissions is highest during the initial air injection period, and no emissions were detected, the long-term emission potential is considered low. Current BTEX levels at the site are low, therefore, future BTEX emissions are expected to be negligible. Finally, the site is isolated at Eglin Main Base, and is in excess of several hundred feet from any permanently ~~regularly~~ occupied building.

3.3.2 3-Month and 1-Year Bioventing Results

3.3.2.1 System Operation

Upon initial startup of the air injection system at 92 cfm, the oxygen influence was monitored at MPC, 40 feet from the VW. The initial oxygen level at this point was 0 percent. After 17 hours at the 92 cfm injection rate, the oxygen content at the deepest injection point of MPC had risen to approximately 20 percent. Since sufficient oxygen ~~was being~~ supplied within this 40-foot radius of influence, the air injection flow rate of 92 cfm was maintained throughout the remainder of the 1-year bioventing pilot test study. Weekly system checks were conducted to ensure consistent system operation and performance.

35' screen
almost 3cfm/ft

3.3.2.2 *In Situ* Biodegradation Rates

Initial, 3-month and the 1-year *in situ* respiration tests and initial and 1-year final soil sampling events were completed as part of the bioventing pilot test. Table 3.4 shows the estimated fuel degradation rates in milligrams of TRPH per kilogram of soil per year (mg/kg/yr) at MPA, MPB, and MPC locations, based on the initial, 3-month and 1-year respiration tests.

Initial biodegradation rates ranged from 220 to 1,400 mg/kg/year. After 3 months of bioventing, rates increased to 620 to 3,800 mg/kg/year indicating a significant increase in bioactivity (i.e. growth in the bacterial population) since startup of the system. At the end of the 1-year testing period, rates had declined slightly for several monitoring points but increased for others. Biodegradation rates ranged from 270 to 6,300 mg/kg/year. The decline in rates at the end of the testing period is probably due to the reduction of fuel (substrate for bacteria) remaining in the soils.

TABLE 3.4
RESPIRATION AND DEGRADATION RATES
OLD EGLIN FTA (SITE FT-28)
EGLIN AFB, FLORIDA

Location-Depth (feet below ground surface)	Initial (March 1994) [e]			3-Month (September 1994) [b]			12-Month (July 1995) [f]		
	K_o (% O_2/min)	Degradation Rate (mg/kg/year) [a]	Soil Temperature (°C)	K_o (% O_2/min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)	K_o (% O_2/min)	Degradation Rate (mg/kg/year)	Soil Temperature (°C)
MPA (4.5 - 5')	0.0042	1,400	14.8	0.0018	620	NS	0.0061	1,100	28.4
MPA (25.5 - 26')	NS [c]	NC [d]	NS	0.00011	28	NS	0.0090	270	NS
MPA (38.5 - 39')	NS	NC	21.3	NS	NS	NS	NS	NC	21.8
MPB (4.5 - 5')	NS	NC	NS	0.0027	930	NS	0.031	5,600	NS
MPB (25.5 - 26')	0.0035	900	NS	0.00051	130	NS	0.0049	150	NS
MPC (4.5 - 5')	NS	NC	NS	0.011	3,800	NS	0.035	6,300	NS
MPC (25.5 - 26')	NS	NC	NS	0.0015	380	NS	0.0094	280	NS
MPC (38.5 - 39')	0.0013	220	NS	NS	NS	NS	NS	NC	NS

[a] Milligrams of hydrocarbons per kilogram of soil per year.

[b] Degradation calculation assumes moisture content of the soil is average of initial and final moistures.

[c] NS = Not sampled. [d] NC = Not calculated.

[e] Due to a delay in power installation, the extended test did not begin until July 6, 1994.

[f] Assumes moisture content of 5 foot depths equal to the average soil moistures determined at VW-3-5 and MPB-2-4 for July 28, 1995 soil samples. Soil moisture at 26 foot depths assumed to be equal to moisture content at MPA-33-34 collected on October 20, 1995.

N:\726876\ENG\oldftarap\T-3-4.XLS

3.3.2.3 1-Year Soil and Soil Gas Sampling Results

Upon completion of the 1-year study, final soil and soil gas samples were collected from the initial sample locations. Table 3.1 shows the initial , and 1-year soil and soil gas laboratory sampling results from the VW, MPA, and MPC locations. As shown on Table 3.1, BTEX and TVH concentrations in soil gas and BTEX concentrations in soil were significantly reduced. However, TRPH concentrations at one of the three sampling locations increased. These increases in concentration may be attributable to spatial variations in TPH concentrations in the soil.

3.3.2.4 Recommendation for Full-Scale Bioventing

Based on the positive results of the 1-year bioventing pilot tests, AFCEE has provided funding for the design and installation of an expanded bioventing system that will remediate remaining contaminated soils at the old Eglin Field FTA. AFCEE has retained Parsons ES to continue bioventing services at Eglin AFB and to complete the design and installation of an expanded bioventing system. Based on the initial pilot test results, available analytical data, and recently completed soil sampling, Parsons ES has prepared a conceptual full-scale upgrade design that will employ the existing VW, existing monitoring well FT28-03, and up to four additional VWs. Three additional MPs also will be installed to ensure oxygen is being delivered to contaminated soils. During installation of the boreholes for the additional MPs and VWs, field observations of contamination will be used to determine the necessity of the VWs proposed. Section 4 provides details on the design, construction, and operation of the expanded system. A design package has been prepared for construction of the system and is included in Appendix A of this RAP.

4. EXPANDED BIOVENTING SYSTEM

Provide specs

The purpose of the expanded bioventing system is to provide oxygen to stimulate aerobic biodegradation of the remaining soil contamination present ~~at the~~ old Eglin FTA. Four additional air injection VWs and existing monitoring well FT28-03 will be used to provide oxygen to the remaining oxygen-depleted, unsaturated and contaminated soils at the site. Three additional MPs will be installed to ensure that oxygen is being delivered to contaminated soils. System design details are provided in Appendix A.

4.1 OBJECTIVES

Following its installation, the primary objectives for the expanded bioventing system will be to:

- Fully aerate the unsaturated subsurface in areas at the site designated for bioventing remediation;
- Reduce hydrocarbon concentrations in soil to below acceptable regulatory cleanup criteria;
- Eliminate the potential for contamination to migrate and adversely affect groundwater quality at the site by removing the contaminant source from vadose soils; and
- Provide the most cost-effective remediation alternative for petroleum hydrocarbon contaminants at the site.

4.2 BASIS OF DESIGN

Site investigation data, pilot test data, and experience at other bioventing sites provide the main elements of the basis of design. The expanded bioventing system was designed to provide oxygen to areas of significant soil contamination. Both vadose zone and smear zone contaminated soils have been targeted. The design includes installing four VWs and three MPs.

Pilot test data, such as operating pressure and radius of oxygen influence, were considered during design development. These data were considered in the spacing of VWs and sizing of a full-scale blower system. In addition to the pilot test data from these sites, experience at other sites with similar soil types was considered in design development. Experience at other sites was used only where there were shortcomings in the pilot test data, such as uncertainty in accuracy of the flow rate data.

The significant design parameters and considerations are as follows:

- A radius of oxygen influence of 60 feet was used, resulting in a 110 foot spacing between VWs. However, to effectively treat potentially higher contaminated soils in the area of concern (near the burn pit) VWs have been spaced more closely.
- An air injection pressure of 3 to 5 inches of water was assumed in sizing the full-scale bioventing blower. This is consistent with pressures observed during the extended pilot test.
- An air injection flow rate of 30 cfm per VW (approximately one cfm per foot of screen) was assumed based on the pilot test system performance and experience at other sites.

The locations of the three additional MPs were selected such that they would provide information as to the extent of vadose zone and smear zone contamination, would be useful in evaluating the magnitude of contaminant reduction through soil gas sampling, and would provide important oxygen influence data. The proposed MPs both will be located near potential "dead zones" and on the periphery of the design radius of oxygen influence (Figure 4.1).

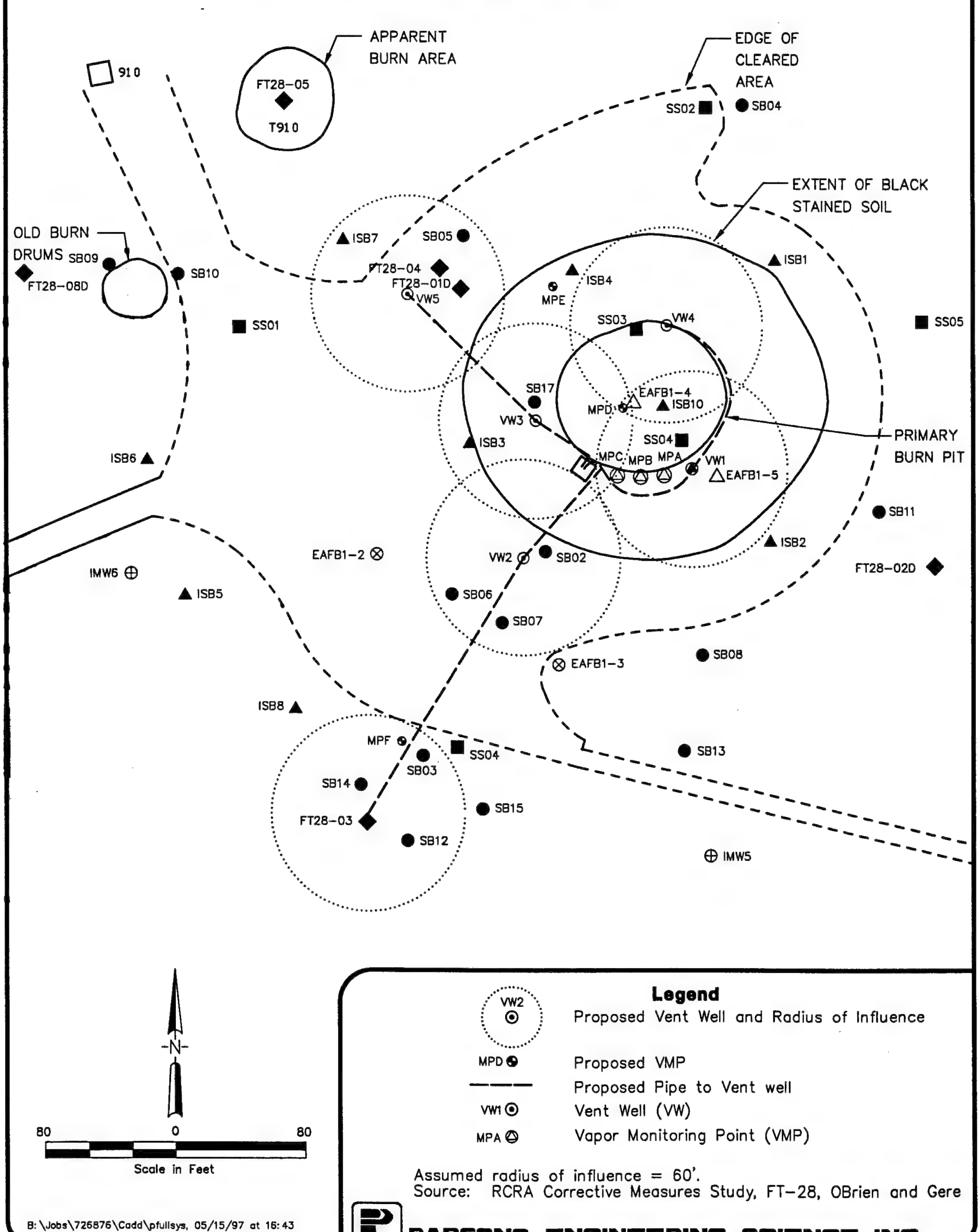
4.3 SYSTEM DESIGN

The proposed upgrade to the existing bioventing system will incorporate the existing VW, existing monitoring well FT28-03, and up to four new VWs. Three new MPs will also be constructed to monitor soil gas at the site. The additional VWs will be installed to ensure proper oxygen influence throughout the area of the soil contamination. The new VWs will be 2 inches in diameter and will be screened with 0.040-inch slot from 5 to 40 feet bls. Figure 4.1 shows the proposed locations of the existing and new VWs and MPs with the estimated radius of influence. The piping from the blower to the new VWs will be installed below ground. Design details are included in the design package provided in Appendix A.

The VWs will be manifolded using 1.5-inch-diameter, high density polyetheylene (HDPE) piping as the conduit for the injected air to flow from the blower to the proposed VWs. The piping will be connected to a new 3 HP regenerative blower and will be set inside a new weather-proof enclosure. A separate (manual) flow control valve and flow measurement port will be included in the lines connecting each VW to allow adjustment of the air flow to each VW. 2 unacceptable

Based on experience at other bioventing sites, a maximum injection rate of 35 cfm at each VW and 5 cfm at monitoring well FT28-03 should be sufficient to supply oxygen to the remaining contaminated soils and sustain *in situ* fuel biodegradation. The radius of oxygen influence around each VW was estimated to extend greater than 40 feet based on the data collected during the initial pilot testing. The VW locations were selected to make use of existing MPs and to provide coverage of contaminated soils. With the exception of monitoring well FT28-03, a spacing of approximately 110 feet (not-to-exceed distance) between VWs is planned.

Proposed Full Scale System Configuration
Eglin Main Base Old FTA (FT-28)
Eglin AFB, Florida



4.4 PROJECT SCHEDULE

Following review and approval of the system upgrade RAP by AFCEE/ERT, Eglin AFB, and the Florida Department of Environmental Protection, field work will begin. The project schedule, presented on Figure 4.2, for the upgrade is contingent upon timely approval of this RAP.

4.5 SYSTEM OPERATION AND MONITORING

Following system installation, an Operation and Maintenance (O&M) plan and record system drawings will be prepared.

4.5.1 System Operation

At startup of the full-scale system, it will be necessary to optimize the air injection rate and to ensure proper operation of the blower system. Flow rate optimization is accomplished by gradually increasing the flow rate to each VW until soil gas oxygen concentrations at all MP depth intervals reach a minimum concentration of approximately 10 percent. Oxygen levels in excess of 10 percent at the outer MPs may indicate that the volume of air passing through the soil exceeds the biological oxygen utilization. The blower will be checked to ensure that it is producing the required flow rate and pressure for air injection.

O&M requirements for the proposed bioventing system are minimal. The regenerative blowers are virtually maintenance-free. The only recurring maintenance required is a monthly check of the air filter, which is generally replaced when a pressure difference of 10 to 15 inches of water across the inlet filter is reached. The time period between filter changes is dependent on site conditions, and is typically every 3 to 6 months. The O&M manual will further detail operation requirements.

4.5.2 System Monitoring

Monitoring of the bioventing system will include system checks of blower operation, including outlet pressures, inlet vacuum, and exhaust temperature every 2 weeks. These system checks will be performed by Eglin AFB technicians.

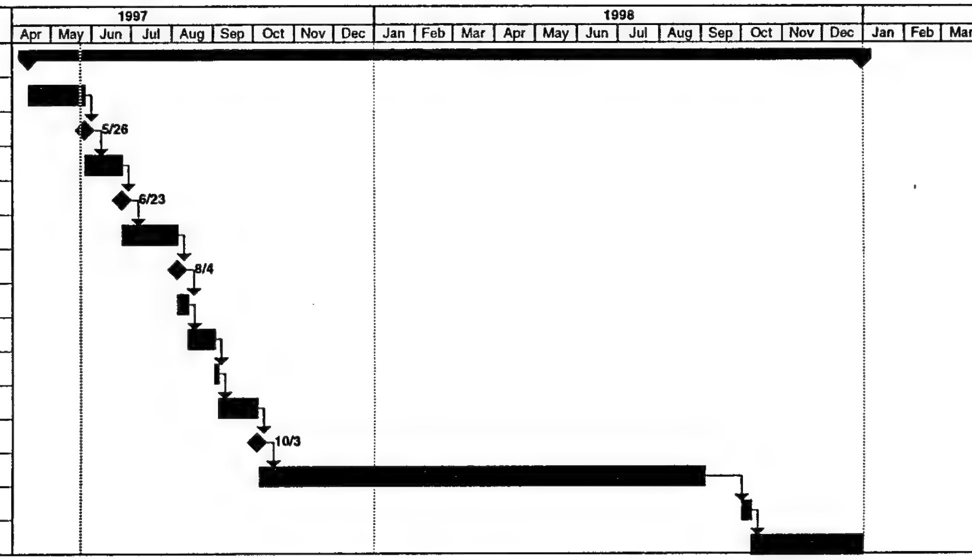
Soil samples will be collected from all boreholes advanced during drilling activities for installation of the full-scale bioventing system components. Samples will be collected at 5-foot intervals, and will be screened in the field for organic vapors using a OVA. Five soil samples will be sent to an analytical laboratory for analysis of BTEX by U.S. Environmental Protection Agency (USEPA) Method SW8020 and TRPH by USEPA Method SW8015 modified. These samples will be collected from the boreholes advanced for the MPs if significant contamination is encountered at these locations.

Soil gas sampling will be conducted at all MPs and VWs prior to system startup to establish baseline oxygen, carbon dioxide, and TVH levels using field instruments. In addition, soil gas samples from five locations will be forwarded to an analytical laboratory for analysis of TVH and BTEX by USEPA Method TO-3. The locations of these samples will be determined based on the field screening results. The five intervals

Figure 4.2

Schedule of Activities
Expanded Bioventing System
Eglin Main Base Old FTA, Eglin AFB, Florida

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Eglin Main Base Old FTA**	448d	4/14/97	12/30/98	
2	Draft RAP Preparation	31d	4/14/97	5/26/97	
3	Deliver Draft RAP to AFCEE and Eglin AFB	0d	5/26/97	5/26/97	2
4	Review and Comment	20d	5/27/97	6/23/97	3
5	Deliver Final RAP to AFCEE, Eglin AFB, and FDEP	0d	6/23/97	6/23/97	4
6	Regulatory Review	30d	6/24/97	8/4/97	5
7	Regulatory Approval	0d	8/4/97	8/4/97	6
8	Field Mobilization	6d	8/5/97	8/12/97	7
9	Construction of System Upgrade	14d	8/13/97	9/1/97	8
10	System Start-up and Shakedown	3d	9/2/97	9/4/97	9
11	Preparation of O&M Manual	21d	9/5/97	10/3/97	10
12	Deliver O&M Manual, Record Drawings, and Letter Results Report to AFCEE and Base	0d	10/3/97	10/3/97	11
13	O&M Effort	238d	10/6/97	9/2/98	12
14	One Year Respiration Test and Soil Gas Sampling	5d	10/1/98	10/7/98	13FS+20d
15	One Year Monitoring Report	60d	10/8/98	12/30/98	14



Project:
Date: 5/23/97

Task — Progress — Milestone — Summary — Rolled Up Task — Rolled Up Milestone — Rolled Up Progress

I:\EGLIN\726876\OLDEGRAP\RAP\OLDEGFTA.MPP

exhibiting the highest TVH concentrations based on field instruments will be sampled for laboratory analysis.

Following startup and optimization of the bioventing system, Parsons ES personnel will remain on site to ensure that adequate oxygen influence has been achieved. System performance monitoring by Parsons ES under Option 1 of the Extended Bioventing Project will include *in situ* respiration testing during a site visit after 1 year of full-scale system operation. Soil gas samples will also be collected from the same five points sampled during full-scale system installation and reanalyzed for BTEX and TVH using USEPA Method TO-3. No soil sampling will be performed under Option 1 of the Extended Bioventing Project.

Prior to performing the 1-year respiration tests and soil gas sampling, the blower will be turned off for 30 days to allow soil gas to equilibrate so that 1-year data can be compared to initial soil gas data. Air will be injected into VWs or MPs for approximately 20 hours, and then shut off. Oxygen uptake will be monitored in the MPs for approximately 72 hours to measure the rate at which oxygen decreases in the soil gas. These data will then be used to estimate the current biodegradation rates and to evaluate the progress of contaminant removal and system effectiveness. As the fuel in the soil is depleted, the respiration activity of the indigenous microorganisms is reduced, and slower oxygen utilization rates will be measured. The use of oxygen utilization and soil gas chemistry as indicators of remaining contaminant concentration decreases the likelihood of premature closure soil sampling events.

System monitoring and *in situ* respiration test data will be analyzed to determine the progress of soil remediation. Estimates of contaminant reduction and time remaining to complete soil remediation will be based on the data collected during the respiration tests (oxygen utilization rates), quantitative estimates of the long-term biodegradation rates, and decreases in soil gas concentrations. If soil gas data indicate that the soils have been sufficiently remediated, closure soil sampling may be recommended.

The monitoring schedule for the full-scale system will be as follows:

Event	Frequency
Blower Vacuum/Pressures and Temperatures	Bi-weekly
Respiration Testing	Annually
Soil Gas Sampling	Annually

5. HANDLING OF INVESTIGATION-DERIVED WASTES

All soil cuttings will be containerized in drums staged at the site. Following completion of drilling activities, the Eglin AFB contact will be notified. It is anticipated that less than 9 cubic yards of soil cuttings will be generated during installation of the full-scale bioventing system.

Decontamination of augers, sampling equipment, and all other items requiring decontamination will be performed at a temporary decontamination area set up at the site. Decontamination water will be placed in 55-gallon drums and stored at the site. Eglin AFB will be responsible for ultimate disposal of all the drummed waste.

6. BASE SUPPORT REQUIREMENTS

The following support from Eglin AFB is needed prior to the arrival of the drillers and the Parsons ES team:

- Assistance in obtaining a Base digging permit.
- Obtaining all necessary regulatory permits for the VWs and MPs.
- Assistance in obtaining any air permits required.
- Provide a copy of any Base soils management plan (SMP) and/or sampling and analytical procedures (SAP) plan.
- Provide any paperwork required to obtain gate passes and security badges for drilling personnel and two Parsons ES employees. If required by the Base, vehicle passes will be needed for two Parsons ES trucks, one drill rig, and two drilling support trucks. These passes must be valid for the expected duration of drilling operations (about 1 week) and the full-scale system installation and startup (about 3 weeks).
- A potable water supply for well construction and decontamination activities.

During full-scale bioventing, Base personnel will be required to check the blower systems once every 2 weeks to ensure that they are operating properly, record air injection pressures and temperatures, and replace air filters, as needed. Parsons ES will provide a maintenance procedures manual and a brief training session.

- If the blower stops working, notify Mr. Steve Ratzlaff of Parsons ES at (404) 235-2361, Mr. John Ratz of Parsons ES - Denver at (303) 831-8100, or Major Ed Marchand of AFCEE at (210) 536-4364.
- Arrange site access for a Parsons ES technician to conduct respiration testing and soil gas sampling approximately 1 year after full-scale system installation and start up.

7. POINTS OF CONTACT

Mr. Ralph Armstrong
AFDTC/EMR
601 Inverness Road
Building 557
Eglin AFB, Florida 32542-5133
(904) 882-7792 Ext. 214
Fax (904) 882-6848
e-mail: armstrongr@ntserver.eglin.af.mil

Mr. John Ratz, Project Manager
Parsons Engineering Science, Inc.
1700 Broadway, Suite 900
Denver, Colorado 80290
(303) 831-8100
Fax: (303) 831-8208
e-mail: john_ratz@parsons.com

Mr. Steve Ratzlaff, Site Manager
Parsons Engineering Science, Inc.
57 Executive Park South, N.E.
Atlanta, Georgia 30329
(404) 235-2361
Fax: (404) 235-2500
e-mail: steve_ratzlaff@parsons.com

Major Ed Marchand
AFCEE/ERT
3207 North Road, Building 532
Brooks AFB, TX 78235-5363
(210) 536-4364
Fax: (210) 536-4330
e-mail: emarchan@afceeb1.brooks.af.mil

8. REFERENCES

Downey, D.C. and J.F. Hall, 1994. *Addendum One to Test Plan and Protocol for a field treatability test for Bioventing - Using Soil Gas Surveys to Determine Bioventing Feasibility and Natural Attenuation Potential*, Prepared for the Air Force Center for Environmental Excellence (AFCEE). February.

Engineering Science, Inc., 1981. Installation Restoration Program - Phase I - Record Search, Hazardous Materials Disposal Sites, Eglin AFB, Florida. USAF, Tyndall AFB, Florida.

Engineering Science, Inc., 1988. Installation Restoration Program - Phase II - Confirmation Quantification - Stage 2. USAF, Brooks AFB, Texas.

Engineering Science, Inc., 1992. Installation Restoration Program - Phase II, Stage 3. Remedial Investigation/Feasibility Study, Eglin AFB, Florida. USAF, Brooks AFB, Texas, December.

Engineering Science, Inc. 1993. Bioventing Test Work Plan For Hurlburt Fire Training Area (Site FT-39), Eglin Main Old Fire Training Area (Site FT-28), Eglin AFB, Florida. Prepared for U.S. Air Force Center for Environmental Excellence. December.

Engineering Science, Inc. 1994. Interim Pilot Test Results Report, Hurlburt Fire Training Area (Site FT-39), Eglin Main Old Fire Training Area (Site FT-28), Eglin AFB, Florida. Prepared for U.S. Air Force Center for Environmental Excellence. August.

Florida Department of Environmental Protection (FDEP). 1995. Memorandum to District Directors and Waste Program Administrators from John M. Ruddell, Director, Division of Waste Management, Subject: Soil Cleanup Goals for Florida. September 29.

Hinchee, R.E., S.K. Ong, R.N. Miller, D.C. Downey, and R. Frendt. 1992. *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*. Prepared for AFCEE. January.

O'Brien and Gere, 1995, RCRA Facility Investigation, Eglin AFB, Florida, Vol. 13, Rev. 0, July.

O'Brien and Gere, 1996a, FT-28 Addendum Report, Eglin AFB, Florida, November 21.

O'Brien and Gere, 1996b, RCRA Corrective Measures Study (Group II), Eglin AFB, Florida, Vol. 9, Rev. 0, November.

APPENDIX A
DESIGN PACKAGE

3
5
7

12
17

CONSTRUCTION DRAWINGS FOR

EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

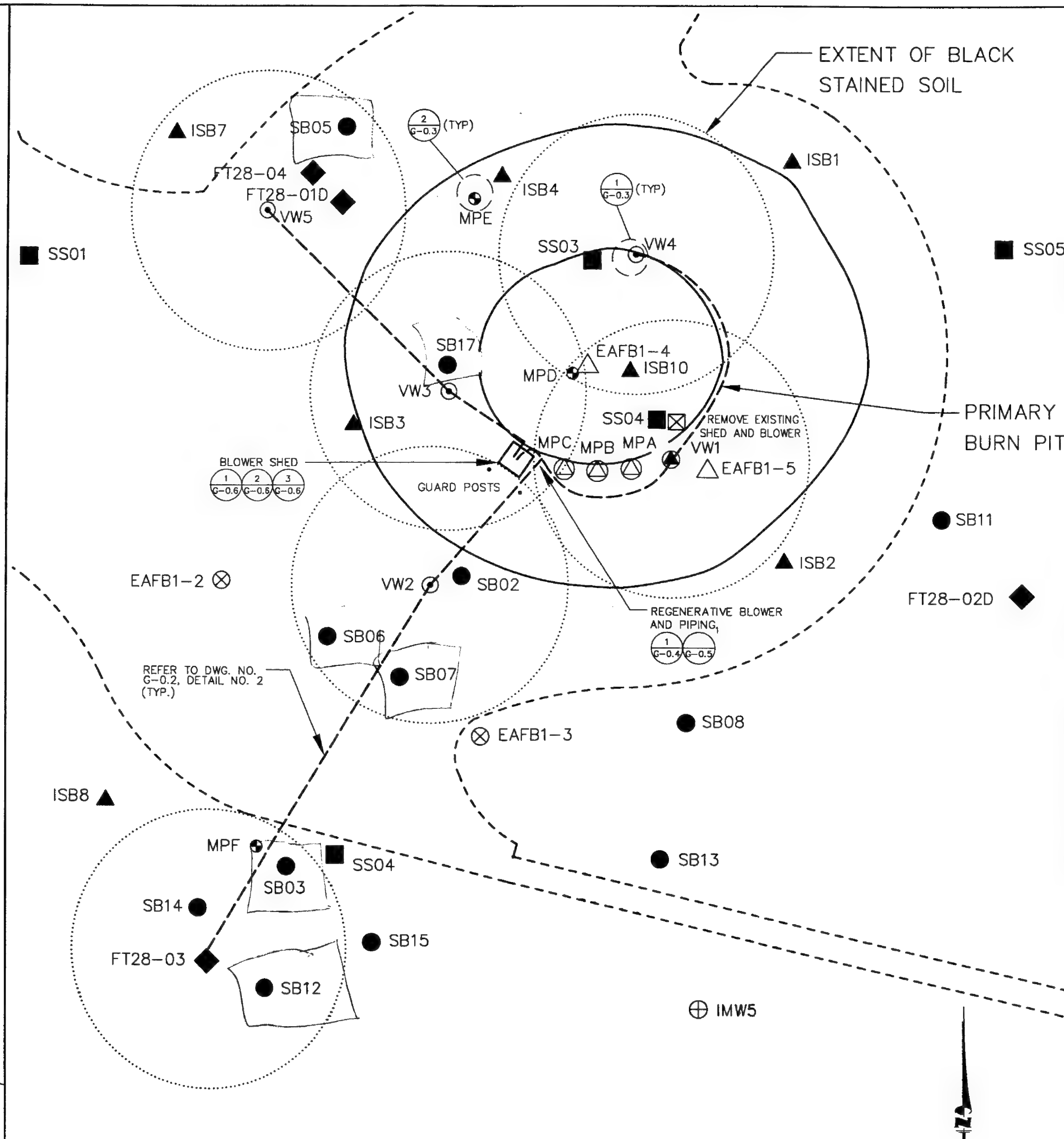
PREPARED FOR

AFCEE

MAY 1997

DRAWING INDEX

B:\Jobs\726876\Cadd\oldegfta\96DN0619A, 05/29/97 at 10:32



SITE LAYOUT

SCALE: 1"=50'

Job No. 726876.43242	Rev	Date	Description	By
Designed SAR	A	5/22/97	65% DESIGN	
Drawn CPC				
Checked				
Reviewed				
Approved				
Reg No				
Date				

PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (404) 235-2300

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

TITLE SHEET AND SITE LAYOUT

DRAWING NO G-0.1

REV B

ABBREVIATIONS

AIJ	AIR INJECTION
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
&	AND
@	AT
CBM	CENTER BACK MOUNT
CFM	CUBIC FEET PER MINUTE
CLR	CLEAR
DIA	DIAMETER
EB	EXPLORATORY BORING
ECC	ECCENTRIC
EW	EACH WAY
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FT	FOOT
GALV	GALVANIZED STEEL
HDPE	HIGH DENSITY POLYETHLENE
ie	FOR EXAMPLE
LM	LOWER MOUNT
MAX	MAXIMUM
MIN	MINIMUM
MP	MONITORING POINT
MPT	MALE PIPE THREAD
NO, #	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
PVC	POLYVINYL CHLORIDE
PW	PROPOSED WELL
RED	REDUCER
REF	REFERENCE
SCH	SCHEDULE
S	SOCKET
SPVC	SLOTTED POLYVINYL CHLORIDE
ST STL	STAINLESS STEEL
TYP	TYPICAL
UST	UNDERGROUND STORAGE TANK
VW	VENT WELL
W/	WITH
WN	WELD NECK
WWF	WELDED WIRE FABRIC

SYMBOLS

MPA ●	EXISTING BIOVENTING MONITORING POINT
MPD ○	PROPOSED BIOVENTING MONITORING POINT
VW-1 ▲	EXISTING VENT WELL
VW-2 △	PROPOSED VENT WELL
– – – – –	PROPOSED HEADER PIPE TO VENT WELL

SECTION DESIGNATION — SECTION NAME

(A / X) **SECTION CUT**

SCALE: NTS

DRAWING OF ORIGIN — SCALE

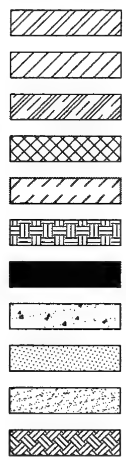
DETAIL NO — DETAIL NAME

(1 / X) **DETAIL DESCRIPTION**

SCALE: NTS

DRAWING OF ORIGIN — SCALE

MATERIAL LEGEND



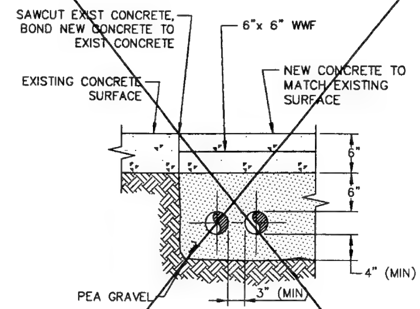
- ASPHALT
- BENTONITE
- BENTONITE/CEMENT GROUT
- BENTONITE PELLETS
- BUILDING (EXISTING)
- COMPACTED BACKFILL
- COMPACTED BASE STONE
- CONCRETE
- PEA GRAVEL
- SAND
- UNDISTURBED SOIL

PIPE MATERIAL

CS	CARBON STEEL
GALV	GALVANIZED STEEL
PVC	POLYVINYL CHLORIDE
SPVC	SCREENED POLYVINYL CHLORIDE

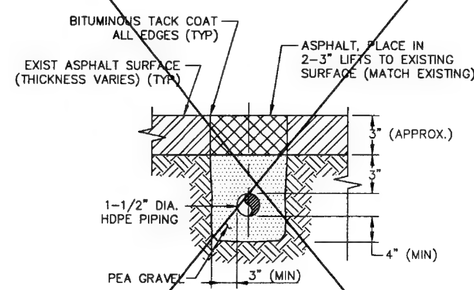
PIPE SERVICE

AIJ	AIR INJECTION
BIV	BIOVENTING
DR	DRAIN



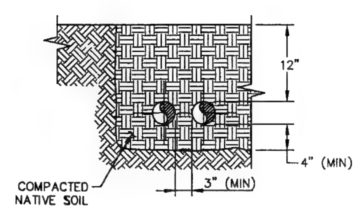
(1 / –) CONCRETE REPLACEMENT DETAIL

SCALE: NTS



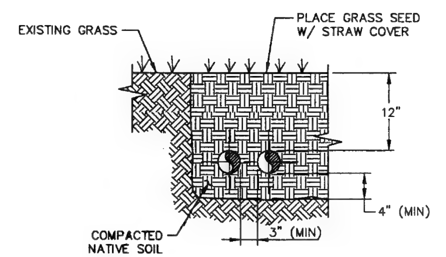
(2 / –) ASPHALT REPLACEMENT DETAIL

SCALE: NTS



(3 / –) SOIL COVER REPLACEMENT DETAIL

SCALE: NTS



(4 / –) GRASS COVER REPLACEMENT DETAIL

SCALE: NTS

B:\Jobs\726876\Cadd\oldegfta\96DN0193a, 05/14/97 at 13:40

Job No. 726876.43242			
Designed SAR			
Drawn CPC			
Checked			
Reviewed			
Approved			
Reg No	A	5/22/97	65% DESIGN
Date	Rev	Date	Description	By

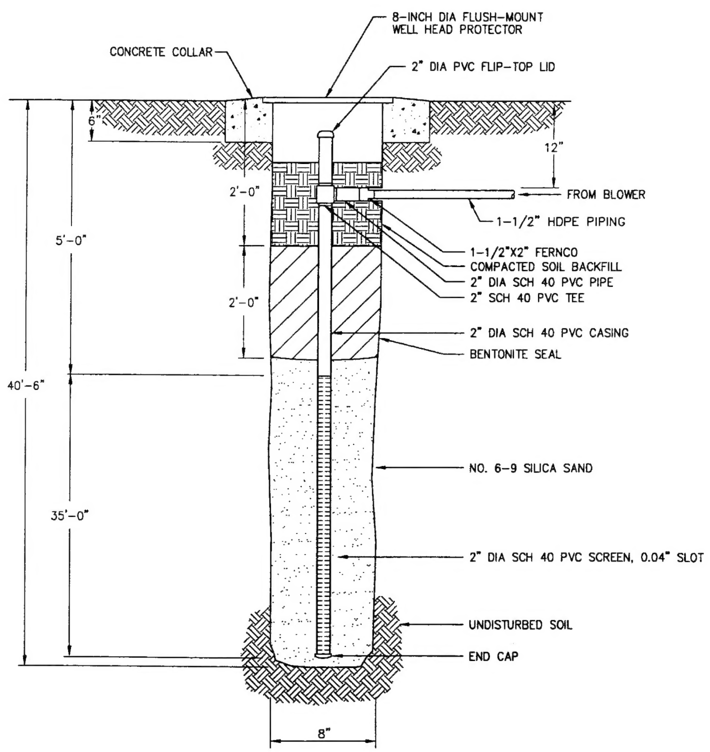
PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (303) 831-8100

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

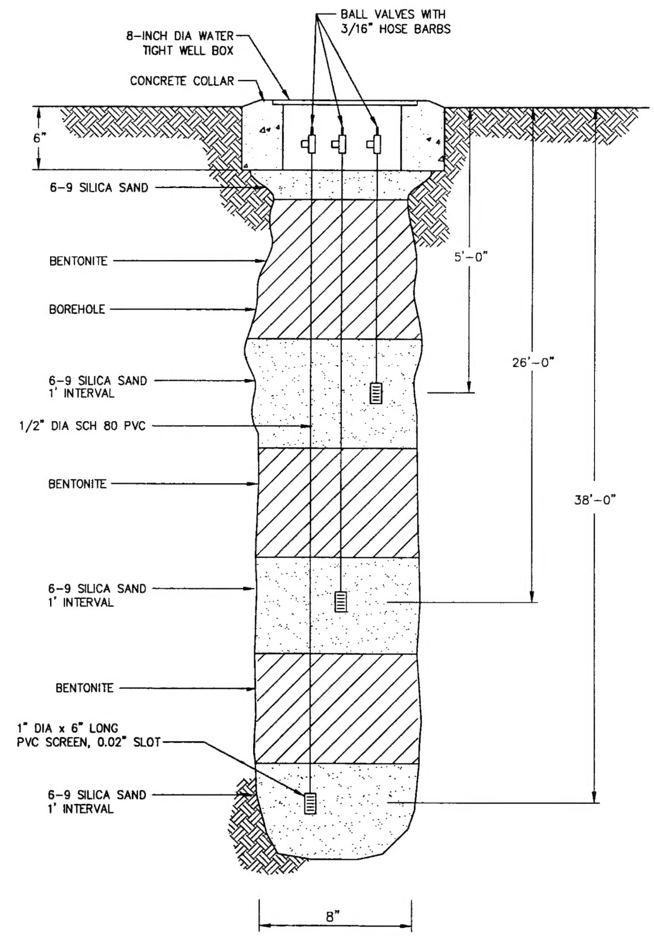
LEGEND AND STANDARD TRENCH DETAILS

DRAWING NO **G-0.2** REV **A**



1 — VENT WELL (VW) DETAIL

SCALE: NTS



2 — MONITORING POINT (MP) DETAIL

SCALE: NTS

B:\Jobs\726876\Cadd\oldegfta\96DN0194A, 05/14/97 at 13:36

Job No. 726876.43242			
Designed SAR			
Drawn CPC			
Checked			
Reviewed			
Approved			
Reg No	A	5/22/97	65% DESIGN
Date	Rev	Date	Description	By

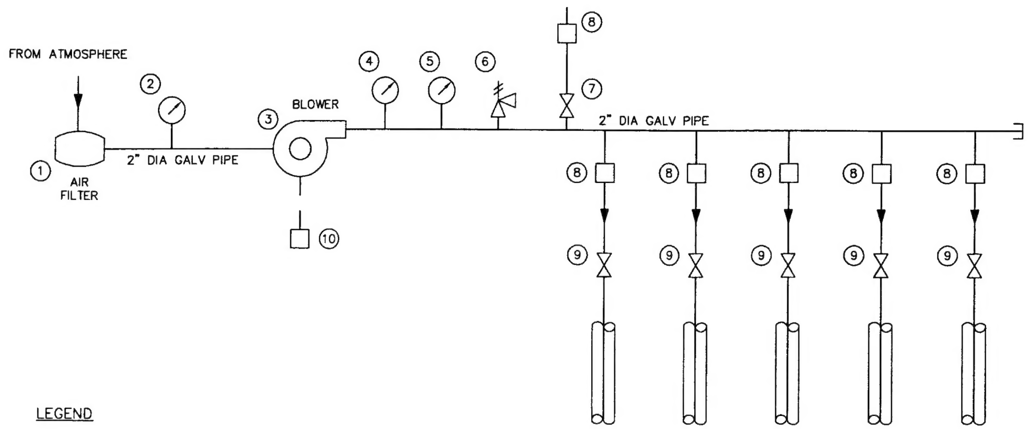
PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (404) 235.2300

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

VENT WELL AND MONITORING POINT STANDARD DETAILS

DRAWING NO: G-0.3 | REV: A



LEGEND

1. INLET AIR FILTER – SOLBERG F-30S-200, REPLACEMENT ELEMENT 30S
2. VACUUM GAUGE – GAST® 2 5/8" DIA, 0-60" H_2O, 1/4" NPT, LM (Part No. AJ497)
3. BLOWER – GAST® 3.0 HP R6130Q-50, 200 CFM AT 10" H_2O PRESSURE
4. TEMPERATURE GAUGE – ASHCROFT, 0-250°F, 1/2" NPT, CBM (Part No. 2A606 FROM GRAINGER)
5. PRESSURE GAUGE – WIKA 611.10, 2 1/2" DIA., 0-60" H_2O, 1/4" NPT, LM (Part No. 9851704)
6. AUTOMATIC PRESSURE RELIEF VALVE – GAST AG258, SET TO RELEASE AT 40" H_2O PRESSURE
7. MANUAL PRESSURE RELIEF (BLEED) VALVE – 1 1/2" GATE
8. FLOW MEASURING PORT FITTED WITH PLUG (1/4" x 1/8" NPT BRASS REDUCING BUSHING, 1/8" NPT BRASS PLUG)
9. FLOW CONTROL VALVE – 1 1/2" GATE
10. STARTER

NOTES

1. ALL PIPING 1 1/2" DIAMETER, GALVANIZED STEEL, UNLESS OTHERWISE NOTED.

1/–

BLOWER PIPING AND INSTRUMENTATION DIAGRAM

SCALE: NTS

B:\Jobs\726876\Cadd\oldegfta\96DN0195A2, 05/27/97 at 09:31

Job No. 726876.43242				
Designed SAR				
Drawn CPC				
Checked				
Reviewed				
Approved				
Reg No	A	5/22/97	65% DESIGN	
Date	Rev	Date	Description	By

PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (404) 235-2300

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

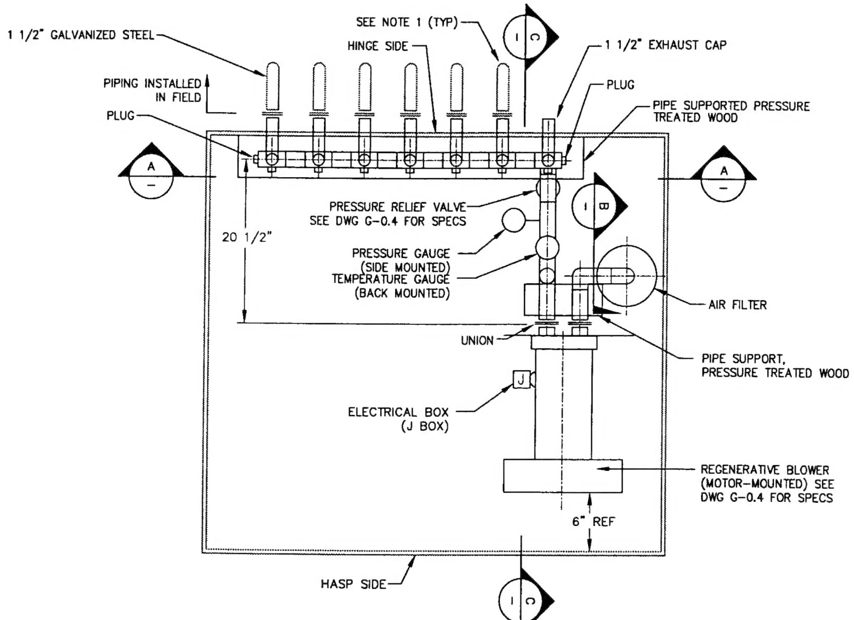
EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

BLOWER P & ID

DRAWING NO G-0.4 | REV A

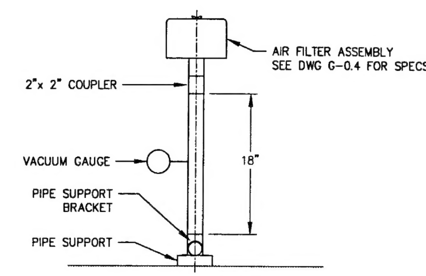
NOTES:

1. SHOP CORE HOLES TO PIPING DIMENSIONS
2. ALL PIPING 2" DIA. GALVANIZED STEEL, UNLESS OTHERWISE NOTED
3. SEE DRAWING G-0.6 FOR BLOWER BUILDING DETAILS



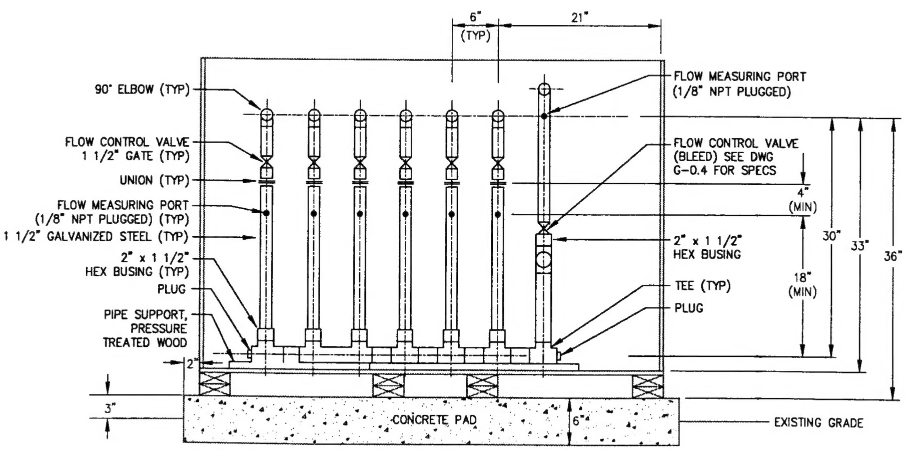
1 BLOWER PIPING LAYOUT PLAN DETAIL

3/4" = 1'-0"



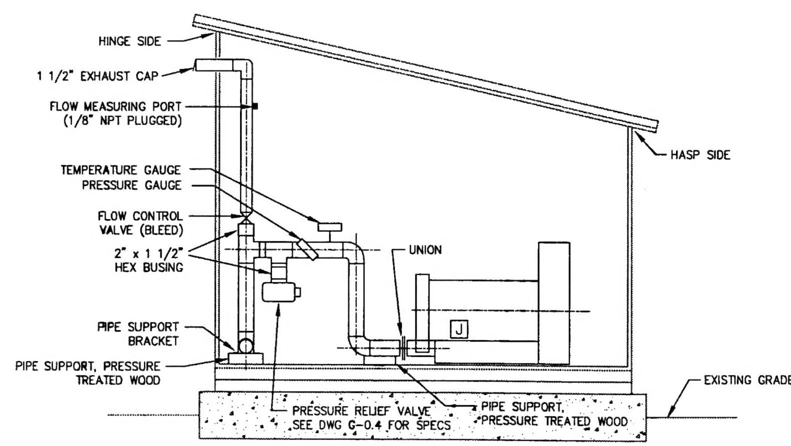
B BLOWER INLET PIPING SECTION

3/4" = 1'-0"



A MANIFOLD DETAIL SECTION

3/4" = 1'-0"



C BLOWER OUTLET PIPING SECTION

3/4" = 1'-0"

Job No. 726876.43242				
Designed SAR				
Drawn CPC				
Checked				
Reviewed				
Approved				
Reg No	A	5/22/97	65% DESIGN	
Date	Rev	Date	Description	By

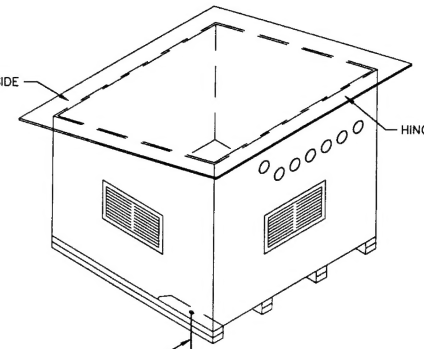
PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (404) 235-2300

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)

EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASES OLD FTA
EGLIN AIR FORCE BASE

BLOWER PIPING LAYOUT DETAIL

DRAWING NO G-0.5 | REV A

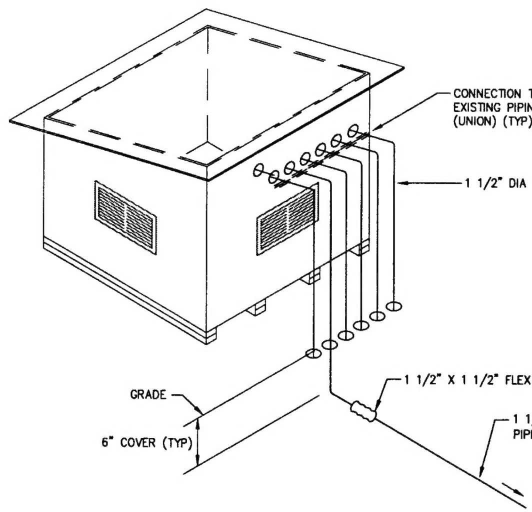


NOTE:

1. FIELD SECURE BLOWER SHED TO CONCRETE PAD AT LOCATIONS BY THRU BOLTING. USE 3/8"x 6" LONG ST STL WEDGE ANCHOR BOLTS, 4 PLACES

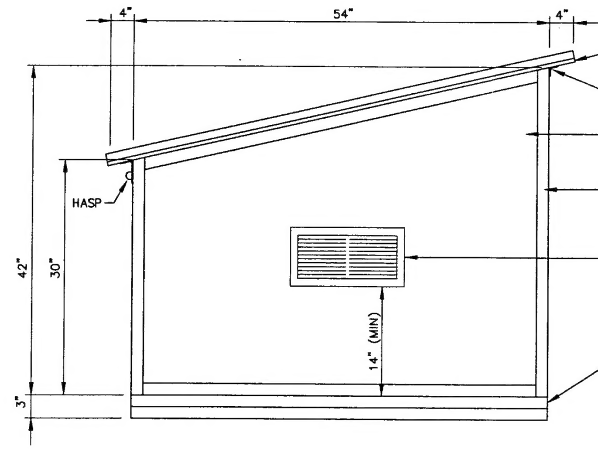
1 BLOWER SHED FIELD INSTALLATION DETAIL

NOT TO SCALE

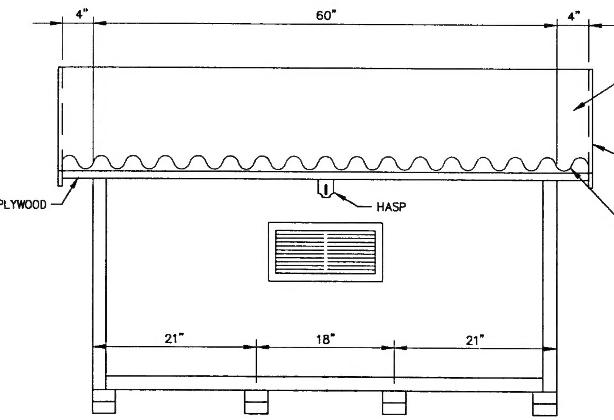


2 TYPICAL MANIFOLD DISCHARGE PIPING LAYOUT

NOT TO SCALE



SIDE ELEVATION



FRONT ELEVATION

NOTES:

1. 2"x 2" FRAME CONSTRUCTION
2. FLOOR CONSTRUCTED OF 3/4" EXTERIOR GRADE PLYWOOD
3. ROOF CONSTRUCTED OF 1/2" EXTERIOR GRADE PLYWOOD COVERED WITH PVC VINYL CORRUGATED ROOFING

3 BLOWER SHED CONSTRUCTION DETAIL

3/4" = 1'-0"

B:\Jobs\726876\Cadd\oldegfta\96DN0197A2, 05/27/97 at 09:42

Job No. 726876.43242	Rev	Date	Description	By
Designed SAR	A	5/22/97	65% DESIGN	
Drawn CPC				
Checked				
Reviewed				
Approved				
Reg No				
Date				

PARSONS ENGINEERING SCIENCE, INC.
Atlanta, Georgia (404) 235-2300

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)
EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER SHED CONSTRUCTION DETAILS

DRAWING NO G-0.6 REV A